

Islands

Models for our Planet – Metaphors for our World



An eBook about islands, co-authored by bachelor students participating in the interdisciplinary lecture series 'Islands: Models for our Planet – Metaphors for our World', offered by the Institute for Interdisciplinary Studies (IIS), University of Amsterdam (UvA).

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The figure on the front page is the logo of the ISLANDS lecture series. The logo has the shape of the supercontinent Pangea (figure produced by Sietze Norder).

Introduction

Welcome to the fascinating world of islands!

This ISLANDS eBook is co-authored by about forty bachelor students who participated in the interdisciplinary lecture series '[Islands: Models for our Planet – Metaphors for our World](#)' offered by the Institute for Interdisciplinary Studies (IIS) at the University of Amsterdam (UvA). The lecture series was an elective course open to students from all disciplinary backgrounds. Nearly eighty students from different universities enrolled for the course, not everyone participated in writing the eBook.

The aim of this eBook is to provide a broad overview of the world of islands. Because it is impossible to do justice to the great diversity and complexity of islands, we have made a selection of interesting island case-studies.

This eBook is subdivided into 13 chapters. Each chapter consists of a number of individual papers that have been peer-reviewed by students. Each co-author chose to focus on one of the following topics: health & happiness, culture & economy, ecosystems & species, energy & materials. The islands are studied by an interdisciplinary team of students with backgrounds in the social sciences, natural sciences, or humanities.

Active discussions among students with different disciplinary backgrounds has created novel insights. Not only about the islands that have been studied, broader lessons have been learnt as well. We hope the readers of this book will appreciate the effort put into each book chapter, and feel inspired to explore the world of islands further.

On behalf of all students who participated in the course,

Sietze Norder
Kenneth Rijdsdijk
Mirko van Pampus
Myrte Mijnders
Cynthia Nagel
Dorien van Kranenburg

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The Falkland Islands

A case study of how socio-economic and biophysical processes influence systems on

the Falkland Islands



Figure 1. (Norder et al., 2014). (Penguin picture from blog.goway.com)

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Abstract

The following chapter discusses research conducted on socio-cultural, economy and biophysical aspects of the Falkland Islands. From a biophysical perspective, the discussion revolves around policies implemented by the government to regulate the large scale fisheries and the impacts this has on biodiversity; specifically the effect on the variety of penguin, bird and pinnipeds species found on the Falklands. We discuss the ways in which these policies are successful in their goals and the potential for such policies to be emulated by other societies around the world. From a socio-economical context, the policies of the Falklands government create innovative ways to aid public services effected by a small population. These polices show how other societies can create a high standard of healthcare, education and policing without seemingly having the resources to do so. Last, the interdisciplinary approach to all island systems points out that both biophysical and socio-ecological systems are characterised by great interrelationship.

Chapter Introduction

The Falkland Islands are an archipelago in the south of the Atlantic ocean, east of Argentina and are British overseas territory. The island group consists of two main islands and over 200 small islands and has one of the smallest population densities in the world. In addition, most islanders live in the capital city Stanley, leaving most of the islands countryside uninhabited. The economy relies most on sheep agriculture, fisheries and tourism (CIA Fact book of the world, 2015). All these sectors are based on the few natural recourses available on the Falklands, namely fish in the surrounding exclusive economic zone and pasture to enable sheep farming. Further, the bare and rocky landscape are, together with wildlife, among which five different penguin species and a great variety in rare seabirds, an attractor of ecotourism.

The Falkland Islands are small and relatively isolated because of their geographical position and therefore its boundaries can be defined a whole lot easier than that of communities, ecosystems or industries on the mainland. This makes the islands an interesting study object. Ultimately, patterns that occur clearly within in a Falkland Islands system may also occur in bigger, more complicated systems, but in a less obvious manner. This could make the island an laboratory or metaphor for these larger scaled systems. In addition, system boundaries become visible earlier in an isolated system, since the output from outside the system is limited. This has implications for the way recourses need to be managed and leads almost automatically to a greater need for sustainability.

This chapter aims to study the implications of being an Island for the socio-economical as well as the biophysical systems on the Falkland Islands. The social-economical focus will be concerned with the implications of the small populations size and density on the island's economy and public services. Having such a small populations has implications on policing, education, healthcare and economics and requires a slightly different approach than these services are normally seen. In addition, the reasons for this small population size will be examined. The biophysical section will be concerned with the effects of large scale fisheries on biodiversity and populations. Furthermore, the (possible) impact of the by the government implemented fishing policy will be taken into account. Finally, this chapter will end with a conclusion and discussion connecting both biophysical and socio-economical findings to achieve a interdisciplinary insight in the Falkland Island system.

The impact of population size, density and isolation on public services and the economy of the Falklands. Innovations which counter implications.



Figure 2: Map of the Falkland Islands (ADST, 2014)

1. Introduction

The Falkland Islands are an interesting case. Despite there being settlers on the island since the 18th century and being colonised since the mid 19th, the island is home to less than 3000 people. Although it has a size of over 12,000 km², the Falklands have the second lowest population density (0.3 people per sq. km) in the world behind only Greenland. Even more interesting the vast majority of the islanders live in the island's capital Stanley which highlights the remoteness of those living in rural Falklands. My question is this, what are the implications of a lowly populated state and the consequent isolation on state services and the economy? How does this impact the policies produced by the Falkland government? It is this resilience, how the island reacts to problems of isolation and population density which can be taken from this case study.

The following will give a broad overview of the context of the paper. The Falkland Island is similar in some aspects to its mother country, the United Kingdom. The two cultures have mirrored one another since such observations were recorded but despite influence, the Falkland Islands cannot offer public services to the same extent as other countries; its low population restricts it from doing so. It is interesting to see how the country is policed when the community is integrated as it is. It could be the case that this deters crime as there is a sense of openness about such a community, or maybe crime rates are higher than countries which have the labour resources to produce a large police force. Along with taking a look at the situation of the island surrounding its policing, research into education and healthcare similarly show differences. The majority of the country's citizens live in the capital city where the only hospital stands; this has implications for the rest of the nation's citizens. However these implications need to be weighed against what is best for society and how the limited resources should be distributed. As such a look at healthcare and education is an interesting one; it pits two rights and necessities in society against the other rights and needs of the Falkland Islanders. The opening

paragraph gives a base for the rest of the essay as it outlines why there is a low population in the first place and summarises the underlying theme. The following provides research into the policing, healthcare, education and economy of the Falklands and how the size of the country's population makes it a different society to other countries with a larger populace. The key message of this research is that the island is resilient due to the state policies which adapt to the problems of the small population and isolation.

2.1 Themes and population background

Prior to discussing ways in which a small population impacts upon various topics within the Falkland society, taking a look into the reasons why the islands have a low density population in the first place gives basis for issues which will later be discussed. The topics which will be outlined here revolve around firstly the climate and secondly institutions within the society. There is constant referral across academic writings regarding the climate of the Falklands regarding its unpredictability (GOV, 2015) and how unfavourable the constant, strong, western wind is (Royal, 2010). But how this is 'troublesome' for vegetation is more relevant to our concerns (Royal, 2006). The fact is that the climate makes for poor vegetation and the Falkland Islands homes greenery which lacks in sustainable nutritious value and it is this limited resource which contributes to the low population density (Royal, 2010). Smith comments upon this further by explaining how this means that the climate constraints produces poor pasture meaning the land for grazing cattle is not sufficient enough to support a larger rural population (Smith 1991). This is important to our explanation because it means that the rural Falkland areas cannot support more people than it currently does, restricting the amount of people who can live in the rural areas because the islands natural resources can only provide livelihood for a limited number. This explains why that the capital city, Stanley, as of 2001 was home to roughly 80% of the Island's population with only 400 people living in rural Falklands (Royal 2006). This is key to understanding why the Falkland Islands has a low population density, because the rural land cannot support a large number of people.

The next issue explains why there is a low population density , however not caused by the natural environment. Gibran (2008) explains how many young islanders move overseas, especially females, to find work, education and a more modern lifestyle than that on the Falkland Islands. Smith comments further stating that the education system in the Falklands is incomplete (Smith, 1991). Laver records the concerns of one such migrant-; He writes that his motivation for moving abroad was based on the fact that there were limited career paths one could inspire to undertake and how if he remained on the island he would be a farm labourer until the age of 65 (Laver, 2001). The number of young persons migrating is emphasised by the nickname 'Stanley North' given to the British city Southampton because of the number of Falklands who migrated there (Beckett, 2012). As we can see, it is not only the island's natural environment which contributes to the low population density, but also the limited opportunities people find themselves presented with when living there.

These implications of isolation and population are the underlying themes of this essay; however, the following will detail the theories which are important to our understanding. Stephen Royle (2015), in his lecture, speaks of the scale of islands and how this is problematic in a variety of ways for smaller islands. A few notable concerns state that smaller islands face problems economically, in its resourcefulness and accessibility. And there are certain limitations of isolation and the size of the Falklands. However, what is more important to our understanding is the modern countermovement; the 'island paradox', addressed

by Peterson (2012) in his lecture, describes a paradigm shift in our assumptions about the resilience of islands (Peterson, 2012). He talks of the advantages of flexibility of isolated islands of which larger communities do not have and refers to island resilience in small islands, like a kayak opposed to a big ship as it is easier to turn around (Peterson, 2016). However, it can be advantageous to be an isolated community as internal policies can build resilience (Briguglio, 2010) and islands of small scale can be sites of innovative conceptualisations (Baldacchino, 2006). The research within this paper shows this to be the case, and from this we can use the Falklands as a case study from which to replicate its policies in other small, isolated communities.

2.2 Policing

One way in which this small island community impacts state services of the Falkland Islanders is through its policing. Chief of Police Barry Marsden was reported to state in an interview with regional journalist Carol Martindale, 'We [Falkland Islanders] don't have burglaries, we don't have violence of any great extreme, we don't (experience) robberies' (NationalNews 2012). This view is universally accepted by scholars, 'crime in the island today is practically unknown' (Strange, 1984), and journalists, 'muggings and pickpockets belong to another world' (Wagstaff, 2001), alike. It is also backed by empirical evidence as shown by the fact that of the island has 10 prison cells, only 4 of which were occupied as of December 2015 (Duikley-Willis 2015). As stated by Marroquin (2014) the small and integrated community makes for an effective balance to keep legal order and corruption low. Specifically because the small society creates a nowhere-to-hide environment where crime is met with exposure referring to the fact that 80% of the country's citizens live in its capital. A study conducted by Rattner (1990) shows a general positive trend between population density and crime rate. However, with focus on the Falkland Islanders, we turn our attention to findings which will open the discussion, and critically assess the impact of the population on the police force. Penguin News is the only newspaper published and distributed in the Falklands and from which the following is taken; In December 2005 two senior police officers were suspended from duty and the strain placed on the police force resulted in a substantial increase of serious crime. Statistics show that there was more serious crime in the 3/4 weeks following the suspension than there was in the year that preceded (Penguin News, 2005). From this we learn that the 25 member police force is needed to keep the Falkland Islands' crime rate as it is. Taking this information into account along with the facts which follow will make it clear why this is a problem.

According to Marroquin (2014) there is a shortage of labour and locals are forced to hold up to three jobs at a time. This shows that low labour resources, from living on an isolated island, can result in increased crime along with a shortage of labour in other professions. Be that as it may, the Falkland Islander's do have the unique advantage of the 'British army [which] works closely with the police force and the chief can call on the military for help if needed' due to the station of a 1000 plus strong army force on the island (McDonald, 2012). This unique situation, following the 1982 war with Argentina, is not applicable to other islands who similarly find themselves with a small police force as a result of isolation. Instead, what we can take from this case study is the fact that the Falklands prove that having a densely populated capital (compared to the rest of the country) where the majority of the country's population live does help combat crime rates as it results in an environment where crime is met with exposure (Marroquin, 2014). Supporting the theory of the paradigm shift that the attributes of small islands can be the source of its resilience.

2.3 Healthcare and Education

Prior to the short war with Argentina in 1982, Falkland citizens found themselves in a position of neglect from the British government, where economic and social conditions were not very promising. Laver (2001) specifically highlights healthcare and education as two particular areas of concern. It is then argued that following 1982 this situation was dramatically improved by British funding. Smith (1991) however argued that this is not the case, as the action of the council with respect to any aid fund shows education expenditure to be a low priority. Further, if we are to look at low population density as a variable, it directly results in incomplete provision in regard to education, for example higher education restrictions and primary education institutions. From his research into education in low populated countries, Brock (1984) offers explanation suggesting why countries with small populations cannot offer educational positions in comparison with larger populated states; –Brock puts this all down to scale. Countries with a low population have to be flexible with the amount of resources available. A system has to be produced as the weigh the need for higher education against other state services. This gives further suggestion as to how the low population density of the Falklands can be detrimental to some extent to society, as education is just one example of how sacrifices must be made as to support other areas of society.

With reference to healthcare, there is only one hospital in the Falklands, the King Edward Memorial. Marroquin (2014) lists this as an increasing concern, especially taking into account that it only offers basic care and for more specialised care patients must be transported Santiago or Punta Arenas in Chile. On the other hand, healthcare in the Falklands can be said to be of a high standard; Because of it's low population, ratio of healthcare provisions to the population is high. Per 1000 residents for example there are 10.2 hospital beds and 2.5 doctors which ranks very high in comparison to all other countries in the world (Statistic Yearbook 2014). Although the country's hospital doesn't provide the entire range of medical procedures, due to the limited population and the small number of people who require these procedures, the Falklands have readily available aircraft services and medevac flights to transport citizens to hospitals which offer these procedures (Royal 1995). However it is the case that due to their being one hospital situated in Stanley, a direct result of the number of citizens outside of Stanley being too distant from one another, this can at times be difficult for people living in rural areas and off- island (Royal 2001).

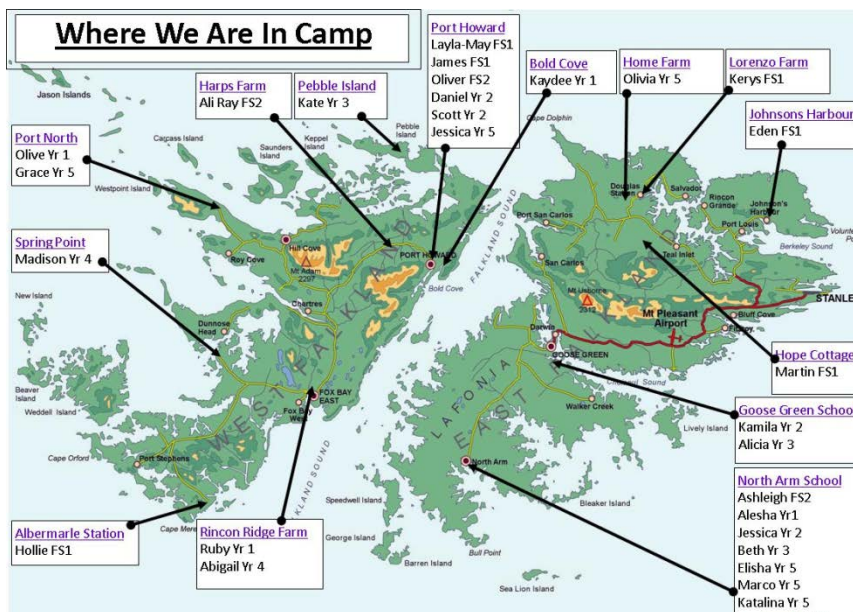


Figure 3: Location of Primary School children in the Camp Stanley system (falklands.info, 2010)

So we can see in both cases of healthcare and education that due to the isolation of the island, the standard is not as high as countries without this characteristic. However, if we turn our attention to a more positive light we can see how The Falkland Islands Government promotes systems of education and healthcare to improve conditions imposed by isolation. If we first take into account

education and focus on travelling teachers in rural areas of the country, we can see that the problem of isolation is minimised. Camp Education is a system where by children not living in Stanley receive Primary education from a circuit of travelling teachers and phone lessons (two weeks followed by four respectively) . Such teachings are aligned with the British National Curriculum and according to Barbara Booth, the islands' education director, this is a very good method for educating the children. This statement is supported by statistical evidence which favours children educated in rural Falklands against those educated in the capital in terms of exam results (Kemp, 2006). As such this can be a model from which countries with educational problems caused by isolation can work from. Similarly, if we are to look at the impact of isolation on healthcare we see that the remoteness of a large percentage of the population results in those people not being able to have access to immediate healthcare. Hitchcock writes of 'first responders' supplementing the work of professionals in the remote locations of the Falklands; This is a system promoted by the Falkland's Government to train its citizens as first responders to medical emergencies. David Jenkins, Director of Health and Education, described one example of which the first responder to a road accident saved the lives of those involved (Hitchcock, 2011). This is a further lesson we can take from this case study as to apply to other remote communities to improve its healthcare. These two examples emphasise Ryan Peterson's theory about the paradigm surrounding island resilience and how small islands, despite isolation and population density issues, can be resilient (2012).

2.4 Economy

An overview of the state of the Falkland's economy states that one of the biggest economic challenges is ensuring healthy competition as many of the goods and services that are offered in the Falklands are only supplied to a handful of providers, in some cases only one. There is fear that firms can monopolise situations by charging excessive prices for goods or services or even limiting their stock of goods as to maximise their profits. It is believed that such actions can hinder development in some sectors of the economy (Falkland Island Government, 2015). Tisdell (2009) looks deeper into such issues; Due to the nature of small communities there is a lack of market competition regarding trade commodities, of which Tisdell refers to as 'imperfect competition'. By this he means that there are restricted number of traders in many industries including transport, the service sector such as banking, types of retail and electricity suppliers to name a few. As there is no competitive policies there is a need to resort to regulations to control profiteering by firms operating in a non- competitive environment. However, such policies may be limited due to the personal connections between business owners and political managers in small island communities. Marroquin for example shows that the Falkland's economy works around such personal networks in the 'confinement of a small territory where most people know each other' (2014). This shows that having a small, isolated population can result in such 'imperfect competition' through firms operating in a non- competitive environment and similarly restrict the politics preventing this due to the nature of small communities. When we look at Jackson's views on the future of the Island's economy he states that 'some degree of monopoly in the retail and service sectors is both inevitable and sensible in a community of this size and isolation' (Jackson, 1977). Unlike other topics we have researched in this case study, the Falklands does not offer a model from which other isolated communities may frame their economic policies on. As such it can be stated that such economic situations in isolated communities have to be accepted. This singular example does not align with the image of resilience which underlines this paper.

3. Conclusion

The Falkland Islands has a small, isolated population due to its environment, landscape and other social reasons; this formed the base for the content of this and follow impact which this had on the state services and economy in the Falklands. The theme is shaped by the theories of island resilience and whether government policies can be influential in improving the state services and economy which are impacted by the demography of the Falklands.

Working chronologically through the paper we can touch upon each section. Firstly the policing of the Falkland islands has it's advantages and can, if need be, aided by the British troops stationed on the island. Crime rate is low but the labour market is in short supply which means it may be hard to replace police officers or bolster the ranks if there were to be future population booms. Despite this, we can see that there is a policy which can be taken from this case study which supports the theory that small islands can be resilient. Having a large percent of the population in one place keeps the crime rate low and this can be applied to other communities where the population threatens the safety of the community.

The paper touched upon how education and healthcare are not at the same standard as other larger communities because of the isolation of members of the population and the resources that would be needed to build more hospitals and schools. This again is due to the population density which negatively impacts upon these state services. Nether the less, further examples can be seen to promote the theory that small island communities can be resilient; these come in the form of traveling teachers and first responders. Both government policies improve the education and healthcare services and again, these can be replicated in other small communities which are impacted unfavourably by population size.

Economically the country is not as resilient. It is a fact that in small communities there will be a level of monopolisation and personal networks between business owners and policy makers contributes to this. This opposes the theory that there should be a shift in thought surrounding small island resilience. But economy aside, this research shows that small communities are resilient. There are policies which can be taken from the Falklands and this paper to aim other small communities around the world. And the traditional theory surrounding the resilience of small island communities is dated.

The effectiveness of regulation of large scale fisheries to limit impacts on biodiversity on the Falkland Islands

1.Introduction

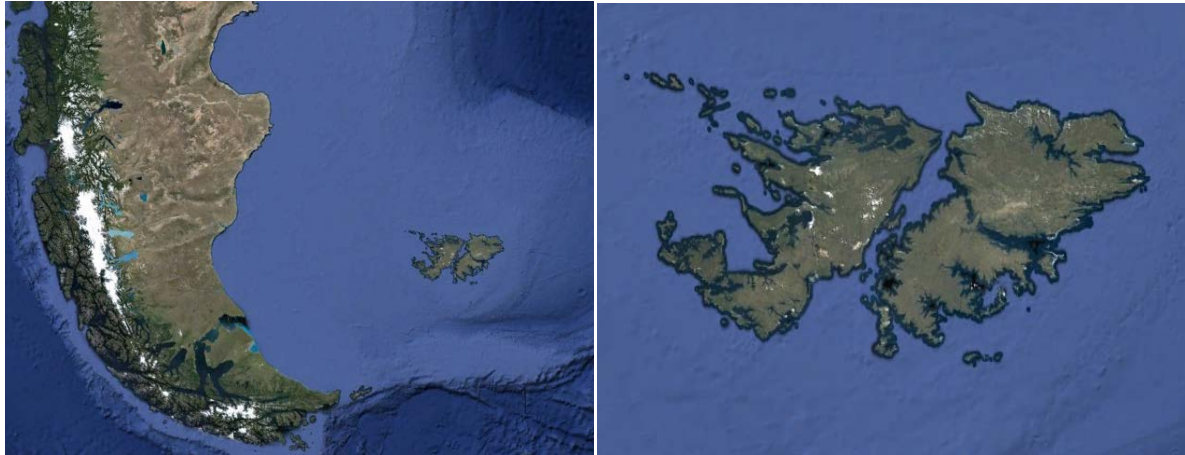


Figure 4: Location of the Falkland Islands (Google Earth, 2015)

The Falkland Islands are located in the Atlantic Ocean, approximately 500 kilometres east of Argentina. Due to the geographical setting at a relatively high altitude and oceanic influences, the climate can be classified as polar with tundra vegetation (Climate Data, 2015). With an average temperature of 5.6 C, a rocky landscape and low rainfall, most forms of agriculture cannot or hardly be practised, with the exception of sheep farming (Falkland Islands Government, 2012). However, since the Falkland Islands government started selling fishing licenses in 1987, the fishing industry has overtaken the sheep farming sector. The Falkland Islands have a 200 nm (nautical miles) fishing zone and fisheries, namely on squids, were responsible for 34% of the total GDP in 2012 (Policy Unit, Falkland Islands Government, 2015). Since the great dependency of the Falkland Islands' economy on this sector, the government has implemented strict regulations in order to monitor fish stocks and ensure their conservation. This included, among other things, fish quota, a limitation on the total amount of fishing vessels as well as seasonal closure of spawning areas (Falkland Islands Government, 2012). Besides from keeping the fishing stock at a healthy level, regulations can also be used to protect the biodiversity and population levels of species that are directly and indirectly influenced by fishing practices. The Falkland Islands are home to, for example, five different penguin species, various seabirds and seals (Otley et al., 2008). For all these species the islands function as breeding area too. Since these animals feed themselves and their progeny with fish, they could potentially compete with fishing boats over food.

The Falkland Islands government and fishing industry are small compared to the global total, so introducing and monitoring the effects of the regulations is easier to achieve. In addition, the fishery system is simplified by the islands' relatively isolated position and thus easier observable too. Therefore, the Falkland Islands case study could function as a "test set" for countries on the main land. This paper aims to investigate the influence of the fishing policy on biodiversity and populations around and on the

Falkland Islands as well as to determine to what extent these fishing regulations could be an example for other countries.

First, attention will be paid to the most common species in the Falkland Islands ecosystem that can be influenced by fisheries and their possibly increased vulnerability as a result of living on an island. Secondly, the different aspects of the implemented regulations will be discussed, as well as their effectiveness and importance. Last, possible future improvements on the fishing policy and the extent to which these regulations are relevant for other fishing systems will be reviewed.

2.1 Influenced populations

To determine the influences of fisheries on various animal populations on the Falkland Islands, the most important species and characteristics of the ecosystem should be discussed. In addition, the fact that these animals live on an island and are isolated to some extent, have less alternatives and thus are less resilient to disturbances. An example is that a large variety of animals living on the Falkland Islands were more heavily affected by a toxic algal bloom in 2003 than animal populations on the mainland (Thompson et al., 2005). This illustrates the vulnerability of small island populations.

The species influenced by fisheries will mainly be animals that live along the coast and have fishes (that are fished on by the Falkland Islands fishing fleet: mainly two squid types and a small variety of finfish (Falkland Islands Government, 2012)) as their most important food source. Since the Falkland Islands consist of many small islands, the coastline is relatively long and provides enough habitats for many sea birds and marine mammals that breed and rest on the island and forage in the surrounding waters (Bingham, 2002). This paper will only focus on animals that return regularly to the island and not to marine animals that never come to land such as whales and dolphins, since these animals have a greater mobility and are less bound to one habitat.

Penguins

The first important animal that can be influenced by fisheries is the penguin. On the Falkland Islands, five different penguin species are present, which live, breed and have their colonies along the coastlines. This concerns the king, southern rockhopper, gentoo, macaroni and magellanic penguin. There have been records of five other species, but these observations are rare and infrequent (Otley et al., 2008). 29% of all southern rockhoppers as well as one third of the global magellanic population live on the Falkland Islands and the gentoo colony is the second largest of the world, which makes protecting these species even more relevant. The macaroni and southern rockhopper penguin have been labelled as vulnerable by the IUCN and the magellanic and gentoo penguin as near threatened (IUCN, 2012). The king penguin has the only population that is increasing, which can possibly be attributed to migration of penguins from colonies on South Georgia to colonies on the Falkland Islands (Otley et al., 2008). This illustrates how island populations can be influenced by migration of flying and swimming animals and that birds and marine mammals on the Falkland Islands are not completely isolated. This has to be taken into consideration when comparing the "closed" island system to a larger "open" system. Bingham (2002) claimed in a study that populations of gentoo, southern rockhopper and Magellanic penguins all decreased in the period of 1982-2002 and that the total penguin population in 2002 was only 16% of

this in 1982. The population decline is visible in figure 5.

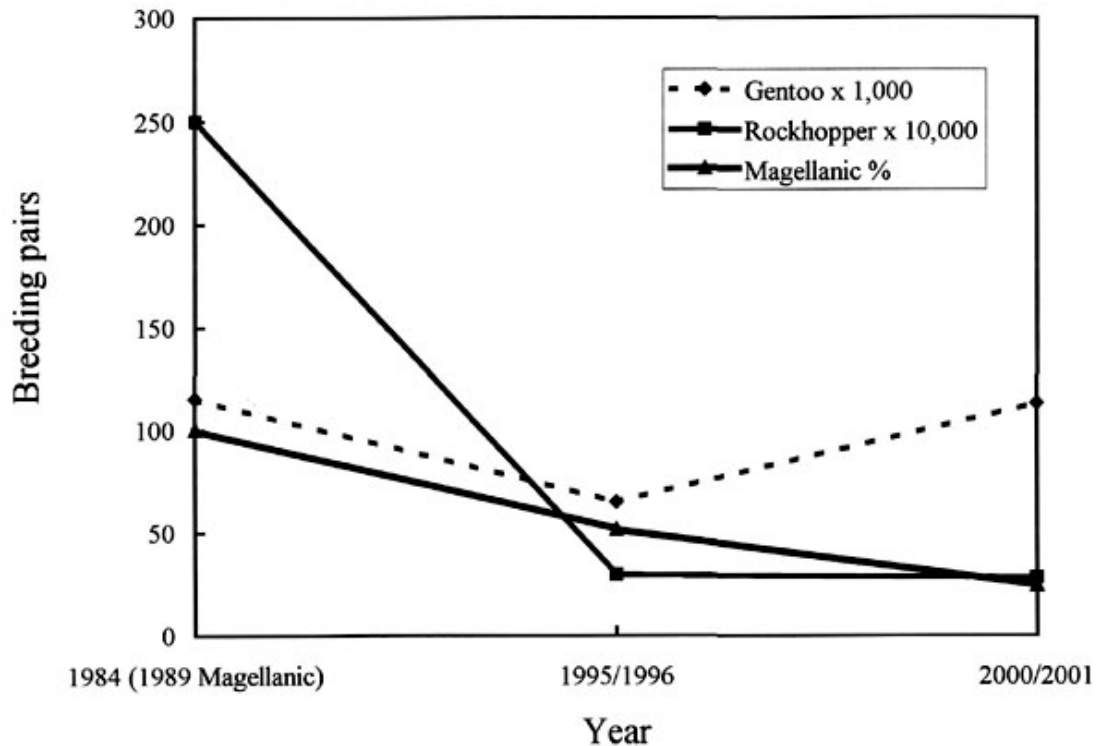


Figure 5: The decline of Falkland Islands penguin populations (Bingham, 2002). The dotted line represents the gentoo, the thick line the rockhopper and the thin line the Magellanic penguin breeding pairs.

This decline began at the same time the Falkland Islands fishing industry began growing and Bingham attributes a share in this decline to increased fisheries, since the diet of these penguins consists largely of fish species that are also wanted by the commercial fishing vessels. For example, the share of squid in penguin diets has become smaller since commercial squid fishing began and was replaced by finfish (Pütz et al., 2001). In addition, populations of the same penguin species living in Chile showed an increase in number after fishing was reduced in the foraging waters.

A study of Boersma et al. (2002) pointed out that different penguin species have different foraging areas while breeding. While gentoos and magellanics stay within roughly 25 kilometres from their colony, rockhopper penguins took foraging trips of sometimes more than 300 km distance from their breeding spots, but also hunted in the same waters as the gentoos and magellanics. The effectiveness of protection measures therefore differs per species; protecting the waters close to the shore will probably benefit gentoo and magellanic penguins more than rockhoppers. Foraging habits of penguins also differ between the breeding and normal season and even within the different stages of the breeding season. Regulations should thus reflect the flexibility of these changing patterns (Boersma et al., 2002).

Birds

The Falkland Islands know a wide variety of birds with a total of 227 species, including 18 water birds and 22 breeding seabirds, which make up most of the population. Thereby, two endemic bird species can be found on the island, namely the Falkland Steamer duck and the cobb's wren of which the last has been listed as vulnerable by the IUCN (2012). However, it is unlikely that these endemic species will strongly be influenced by fisheries since fish is not the largest component of their food intake. Because of the relatively small distance to the South American main land and South Georgia, many bird species visit the Falkland Islands temporally, leading to the high bird biodiversity number (Otley et al., 2008). The sea bird under most threat is the black-browed albatross, which is listed as endangered (IUCN, 2012). About 67% of the total black-browed albatross populations breeds on the Falkland Islands, where the populations is declining with approximately 1% per year (Catry et al., 2011). One of the reasons of this decline is that many albatrosses are killed by fishing trawlers (Sullivan et al., 2006). Black-browed albatrosses and other sea birds are attracted to fishing vessels, which they consider as an easy food source. However, they are killed by the trawler mechanism while foraging on and near the ships. In this case the problem is not competition over food, but the negative effect of by-catch by fishing vessels. Other impacts of the fishing industry were not found (Catry et al., 2013).

Marine Mammals

The last species discussed in this research are the marine mammals, in this case seals and sea lions (pinnipeds), which have their colonies along the islands' coastlines. The pinniped species that occur on the Falkland Islands are the South American fur seal, the southern sea lion, the southern elephant seal and the leopard seal. Only a small share of the global populations of all these species live on the Falkland Islands, and all are not listed as vulnerable or threatened by the IUCN (Otley et al., 2008). However, populations have been much larger in the past and are relatively small nowadays. This was due to large scale hunting of pinnipeds from the 18th century till the 1960s. For example, the southern sea lion population was estimated at 380,000 in the 1930s, but now contains only 7,047 animals (Thompson et al., 2005). The south American fur seals population is with 10,000 slightly bigger, but populations of the southern elephant seal are even smaller. These three species also breed on the Islands, while the leopard seal only visits the islands during the winter (Otley et al., 2008). Small populations face increased vulnerability because of decreased resilience to extreme events. In addition, when colonies become too small there is a danger of inbreeding because of decline in diversity in the colony's gene pool (Savada et al., 2012). Exploitation of pinnipeds is no longer allowed and there have not been records of illegal hunting practices around the Falkland Islands (Otley et al., 2008 ; Thompson et al., 2005). Just like penguins, the foraging behaviour of seals and sea lions differs per season and species. Hunting in during the breeding season occurs relatively close to the islands, but outside the breeding season there have been records of Elephant seals foraging 4000 kilometres away from their colonies (Otley et al., 2008).

2.2 Regulations and their impact

The importance of sustainability on an island

The regulation of the Falkland Islands fishing industry has as purpose to enable sustainable fisheries. While many other (western) countries have been struggling with the introduction of measures to limit catches, the Falkland Islands government has put an ambitious plan to monitor and protect their fish

stocks. This leading role is due to the large share of fisheries in the GDP as well as the relatively low resilience of the economy, which is only based on agriculture, fisheries and tourism. Deschenes & Chertowv (2004) state in their study that islands are often relatively small and isolated closed systems which makes the boundaries of their resources become easily visible. This forces governments to implement regulations to enhance sustainability of ecological resources, which are the fundamentals of most island economies.

The main goal of the regulations is to preserve a healthy fish stock and prevent the fishing industry from collapsing. Protecting wildlife that conflicts with the presence of fishing activities is also dealt with as a side issue (Falkland Islands Fisheries Department, 2013). The ecotourism sector is increasing (Policy Unit, Falkland Islands Government, 2015) and this can further augment the value of conserving the natural ecosystem. Penguins, for example are a main attraction for tourist, which increases their economical value. This further emphasizes the fundamental character of ecological resources for an islands economy, as proposed by Deschenes & Chertowv (2004). In addition, this development could also reduce the need to generate most incomes by fisheries and reduce the stress on fishing stocks even more.

Introduced Regulations

The Falkland Islands Fisheries Department is the organisation responsible for executing measures to enable a sustainable fishing industry. This organisation divided the Falkland Islands' fishing zone into two parts in 1990: the Falklands Interim Conservation and Management Zone (FIZC) which reaches till 150 nautical miles from the island, and the Falklands Outer Conservation Zone (FOCZ) till 200 nm (Falkland Islands Fishery Department, 2013). In addition, in 1991 the South Atlantic Fisheries Commission was established to enhance the exchange of information considering the conservation of fish stocks between the Falklands and Argentina.

The first important regulation introduced around 1990 was the license policy, which is still developing under results of ongoing investigation. It is only permitted to fish amounts of certain species when having the right license. By only selling a limited amount of licenses for relatively popular squid fisheries the fishing department tries to create economical interest for not commonly exploited species to decrease stress on all populations (Falkland Islands Fishery Department, 201). Another major regulation is the seasonal closure of areas where animals forage (marine zoning) as well as the establishment of marine reserves (Falkland Islands Government, 2012). As mentioned previously, different penguin species forage at different distances from their colonies, which would make permanent marine reserves only effective for gentoo and magellanic penguins who forage close to the coast and thus in a smaller area. Marine zoning is however be much more effective for species that go on longer foraging trips, such as rockhopper penguins. Since the foraging behaviour of penguin species, but also that of the pinnipeds on the island differs for each season, marine zoning could be a suitable solution in which the dynamism of populations and their feeding behaviour is reflected (Boersma et al., 2002). As described, both marine zoning and the licensing policy are theoretically expected to have a positive impact on all animal populations, but further research has to be done to quantify their effectiveness. In addition, both measures could be adapted more to wildlife protection, since they are now especially focussed on preserving fish stocks.

In order to reduce the by-catch of sea birds by trawling vessels to an extent that will not influence vulnerable small populations the "Falkland Islands National Plan of Action For Reducing Incidental Catch of seabirds in Trawl Fisheries" was set up in 2009 by the Falklands Conservation. This included examination and mitigation measures. Research concluded that breeding success of black browed albatrosses recently has been increasing and that this may be contributed to these measures taken to decrease the impact of fishing practices on sea birds (Catry et al., 2011).

Finally, an overview study on the state of global marine fisheries listed the Falkland Islands in the highest categories considering sustainability and the capacity to implement regulations, as can be seen in figure 6 and 7 (Mora et al., 2009). Hence the Falkland Islands' fishing industry has the possibility of having the flexible character needed because of large seasonal and annual variation on fish stocks and thus on feeding possibilities of penguins and seals. This flexible character is also established by the large budget of approximately 6 million dollar that is annually spent on monitoring and examining fish stocks (Falkland Islands Government, 2012). Due to this ongoing monitoring, fluctuation in fish populations can be recorded and the amount of sold fishing licenses can be adapted to the new situation.

C Capacity to implement regulations

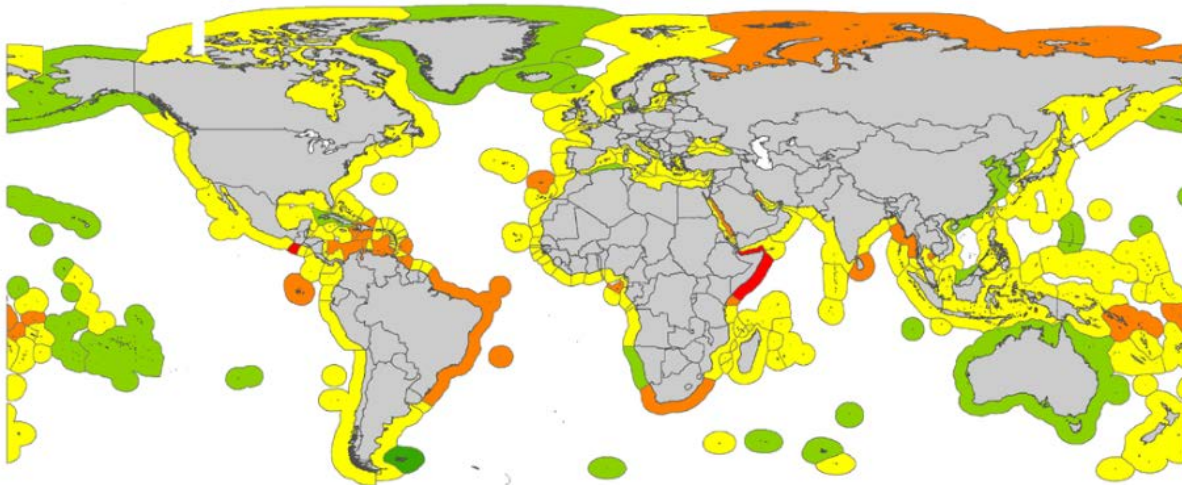


Figure 6: the capacity to implement regulations (Mora et al., 2009)

G Probability of fisheries sustainability

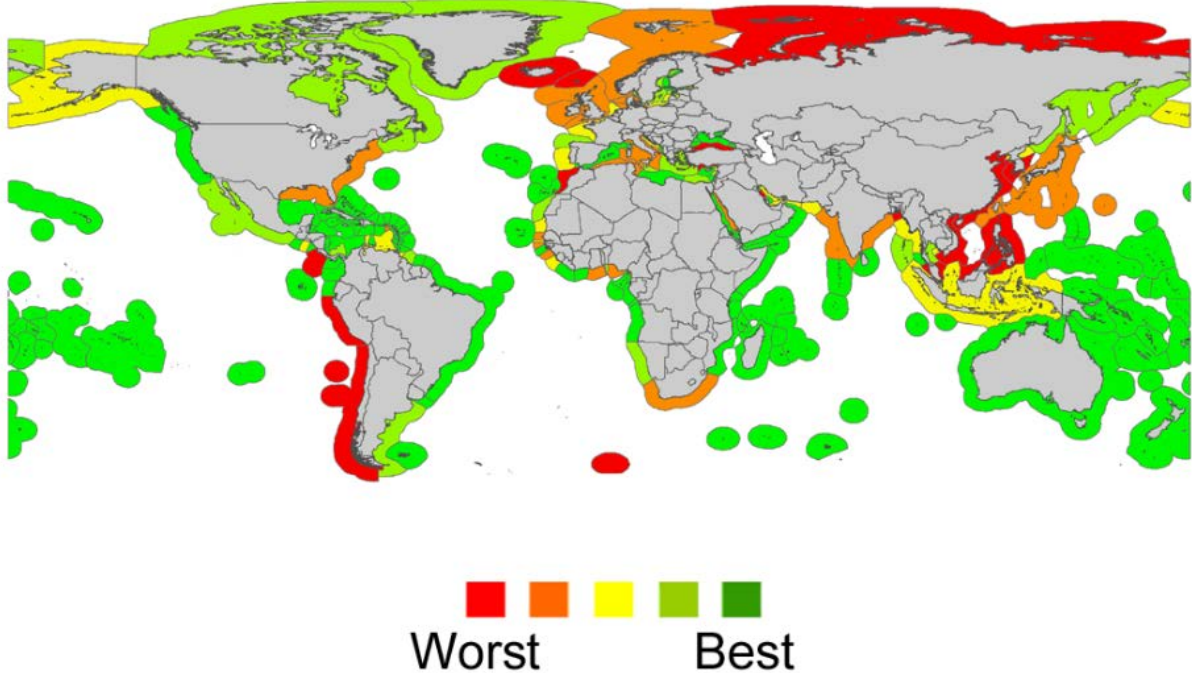


Figure 7: Probability of fisheries sustainability (Mora et al., 2009)

2.3 Falkland Islands as a metaphor for larger systems?

Whether the island case study can be extrapolated to global systems is always a point of discussion. As can be deduced from the descriptions of the Falkland Islands ecosystem and fishing regulations, effectiveness of regulations is strongly bound to species and their foraging patterns and require much flexibility. However, the Falkland Islands can be compared to nearby similar ecosystems in South America, and these similarities can be extrapolated to even larger and fishing industries further away. This up scaling is also mentioned by Deschenes & Chertowv (2004).

In addition, species and ecosystems might not be a one to one comparison, but the management principles remain the same. This is also reflected by the high rating of the Falkland Islands fisheries by Mora et al. (2009). When comparing the effects of policy on a global scale the capacity to monitor changes in fishing stocks and implement these regulations as well as on the extent of sustainability the Falkland Islands are rated high. Being capable of monitoring fish and influenced animal populations is thus of great importance. However, it should be taken into account that monitoring a system is much easier on an island than on a continent. Islands are often smaller, which makes it less expensive and practically easier to monitor populations and encounter less influences from other ecosystems because of their relative isolation. The successful fishing policy is therefore an example of the opportunities islands have because of their size.

3. Conclusion

Based on the information provided, the following can be concluded. The species potentially most influenced by large scale fisheries on the Falkland Islands are penguins, sea birds and pinnipeds.

Penguins and pinnipeds are most influenced by competition over food with the fishing industry, while sea birds face the greatest danger of getting killed while scavenging around fishing boats. All species are able to leave the island since they can swim or fly, but are seasonally bound to their breeding colonies and therefore face the downsides of living on a small island. The Falkland Islands governments has realised that the islands' great dependence on natural resources requires regulations in order to enhance and maintain economic stability. The implemented regulations comprise selling a limited amount of fishing licenses, marine zoning and the introduction of the "Falkland Islands National Plan of Action For Reducing Incidental Catch of seabirds in Trawl Fisheries". These regulations have had impact on both fishing stocks and populations. The number of records of birds dying from trawl vessels has decreased and breeding populations of the black browed albatross started to increase. The other regulations are theoretically suitable for protecting penguins and pinnipeds, but could be more adapted to these specific species. In addition, further research on all threatened species is required to create more evidence of the connection between implemented regulations and population recovery. In addition, the ecosystem of the Falkland Islands resembles ecosystems on the south American mainland and could therefore be used as a model and inspiration to reservation measures in this area.

The Falkland islands fishing industry can be considered as sustainable in terms of fish stock conservation and is characterised by continuous monitoring and research. This ongoing research also plays a fundamental role in maintaining the implemented regulations. Most species have dynamic foraging areas and behaviour, which can also difference per season and fish stocks fluctuate every year. Men can only respond to continuous changing circumstances by making conservation measures dynamic as well. The relatively small size of the islands makes monitoring easier, which illustrates the advantages of a small and relatively closed system. Ultimately, the Falkland Islands fishing policy can be considered as an example for other countries, illustrating the importance and sense of flexible regulations and continuing research. This might be harder to obtain in a larger and less isolated system, but it is likely to have a positive effect on biodiversity and population conservation.

Chapter Discussion & Conclusion

Now that both socio-economical and biophysical aspects are explained in more detail, connections between both can be made in order to view the Falkland Islands from a interdisciplinary perspective.

Lessons Learned

The main lesson that can be learned from the Falkland Island fishing industry and policy is that having the right information at the right time is essential for achieving good results. This includes being aware of the decline of fish stocks or other animal populations influenced by fisheries. This can only be obtained by ongoing research and monitoring, that needs to be supported financially. For many countries these extra costs may be one of the main reasons to not fully monitor their fishing resources, but the dependency of the Falkland Islands on fisheries has made the government realise that keeping their natural resources at a sustainable level is key. As stated in the biophysical part, preserving fish stocks influences wildlife populations to a certain extend and in a positive way. There could, however, be more regulation specifically adapted to vulnerable species. The growing tourism sector could accelerates this development, since wildlife is the main touristic attraction on the islands. The enlargement of the touristic sector could cause an increase in jobs, boosting the economy again. A healthier economy will enable the government to further develop their public services and policy, making this a positive feedback loop. This is also the case for the regulations of the fishing industry,

keeping the stocks at a healthy level, higher revenues can be reached on the long term. This increases the budget available for research. This makes the fishing industry very resilient. Furthermore, The relatively large GDP per capita, partly derived from revenues from selling fishing licenses, enables the government already to provide the high level public services described in the socio-economical chapter. Therefore, the resilience of the Falklands with regard to its public services should not be questioned. The innovation and resourcefulness of the governmental policies prove it to be a flexible country with the ability to use its seemingly disadvantages as an asset. The isolation of a large percent of its population and small population size in general provides strain upon the country through such challenges as creating a universal standard public service to those in remote locations and not having a about force to attend to all of the country's needs. To conclude, the Falkland Island's thrive by their ability to turn limitations into creative or smart solutions. This is partly possible because of their relative welfare and, at the same time, strengthens this welfare even more.

Sustainability

A primary concern when it comes to the sustainability of the island comes down to the landscape and how a part of the population finds itself a long distance away from the capital, from where the islands services run. This indeed makes it difficult to keep a functioning standard of services such as healthcare and education. On top of this we have to take into account that the small population results in a dwindling workforce to run the day to day operations of the services offered by the country's government. This perhaps is why a case study of the Falklands is an important one as it displays how innovative policies produce a sustainable society despite the aforementioned difficulties. These polices which have been discussed in some level of detail throughout the chapter offer guidance to other islands and small communities which face similar troublesome predicaments. In addition, the island's isolation makes shortages of resources quicker visible or, in other terms, the boundaries of the system are reached earlier. This accelerates the need to be sustainable on all aspects, for example the fishing industry. As stated earlier, the flexibility of fishing regulations, caused by the monitoring of fish stocks on the Falkland Islands is the main reason the system is successful and sustainable, but requires a large research budget. Main reason for providing this budget, is that the government is highly financially dependent on this sector and that, as just described, the boundaries of the fish stocks become visible earlier. The fact that the population in rural areas is small, partly because of the low carrying capacity of the land, is also an indication of dealing with limited resources in a sustainable way. This contradicts the common situation in many countries on the main land, that are far less isolated. In these countries, the actual carrying capacities of areas in which a lot of people live are often exceeded, but this does often not become clear right away. The shortage of recourses are imported into the system from outside, creating a situation that is not sustainable. A more Falkland Islands alike monitoring system could be a manner to visualise system boundaries better and obtain more sustainability.

Falkland Islands as an Example

As described in the previous section as well as in the individual papers, the Falkland Islands could have the function of a laboratory for other countries, systems and communities. In the case of sustainability, limitations and borders of the system are made easier to observe. This function of a laboratory could also be valid when comparing the small Falkland community to other small communities that do not necessarily have to be islands. For example, one could think of isolated villages in mountain areas or forests, where creative solutions on the "problem" of being small could be beneficial for these communities. Thereby, the Falkland Island's great dependence on only a few economical sectors could say something about the resilience of these specific economical systems. In addition, the findings concerning the influenced ecosystem can be used as a starting point and reference for examining the effects on bigger and less isolated, but in terms of species biodiversity alike systems on the mainland.

The combination of fisheries and population levels of influenced species could be very useful for all ecosystems that face disturbances from a large scaled fishing industry.

Benefits of the interdisciplinary approach

This final conclusion and discussion aims to connect the aspects of islandness to the aspects of both the socio-economical and biophysical systems. As can be concluded from the previous sections, the biophysical aspects and impacts of the fishing industry are greatly influenced by the fact the Falkland Islands are islands with the associated properties of, again, isolation and more clearly defined system boundaries. Because of these influences, resources from outside the system are limited, which leads to a small population who's economical wellbeing depends on the naturally available recourses. Having a small populations has again an impact on public services and economy, which can influence the extend to regulations can be implemented and monitored. In short, the Falkland Islands are an integrated socio-economical and biophysical system in which the population and government managed to turn limitations and drawbacks into opportunities, leading to a relative sustainable and resilient society and ecosystem.

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Change on the Galapagos

A case study of the Galapagos Islands



Figure 1. Galapagos Islands. Source: (<http://www.gaytravel.com/gay-guides/galapagos-islands>)

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Abstract

There are three topics to be discussed in this chapter about the Galapagos islands. To get to know more about these subjects, the authors made use of literature research. The first analysis finds out what the main changes are for residents on the archipelago due to tourism. Main changes that have been found in the analysis are a shift of main source of income, employment and social conditions. The second analysis wonders if the giant tortoises on the Galapagos archipelago are sustainable. Main findings on this topic are that humans have a big role in the sustainability of the tortoises and that it is important to keep measuring in the future. The last topic analysis if the development of the biodiversity on the archipelago is influenced by plate tectonics and glaciation processes. The conclusion of this paragraph is that the archipelago is very dynamic, not only because of plate tectonics and glaciation processes. The general conclusion of this chapter is that humans have a big impact on all facets of islands. And not only islands, also other isolated places can learn from these analyses.

Chapter introduction

In this chapter, three papers about the Galapagos islands will be discussed. Each of the papers have their own subject of inquiry, with their own perspectives on the islands. But when you read the papers, you will discover an overarching theme. The subject that shimmers through in all three papers, when you view them from a distance, is 'change'. It is commonly known that islands are constantly in change, but this 'change' can be understood broadly. In this chapter, this will be shown. First of all, we are going to look at change on the Galapagos islands from its residents' perspective. The Galapagos islands have gone through a lot of changes because of the growth of the tourism industry. The author of this paper discusses what this meant for the people who lived on the Galapagos and what the perspectives are for the future. Second, we will look at the Galapagos islands from another perspective. This will be about the change of plate tectonics, paleogeography and the biodiversity of the Galapagos islands. This author wonders how these elements have influenced the development of ecosystems and their species on the Galapagos Islands. And then, the last paper will focus on the giant tortoises on the Galapagos islands. This species has gone through tremendous changes and the author of this paper is questioning the sustainability of the giant tortoises.

So why should the Galapagos islands be studied and why did the authors choose for especially these topics? First of all, the Galapagos islands are unique in their combination of their (protected) nature and species, and at the same time dealing with a high rate of tourism. From the 123 islands, islets and rocks, there are only 5 islands that are inhabited. Most of the islands, or parts of them, are UNESCO world heritage. Even on the 5 inhabited islands, parts are national park and only allow a certain amount of visitors per year. This, obviously didn't come out of nowhere. The population of giant tortoises and other species declined over the years, while tourism kept growing. Although these several subjects are already represented in the scientific literature apart from each other, this is a unique opportunity to combine them to create a new perspective.

In the first paragraph the impact of tourism on the residents of the Galapagos islands will be discussed. The second paragraph will be about the sustainability of giant tortoises. And finally the third paragraph will be about biodiversity and development.

Peer-reviewed individual papers

1. Tourism on the Galapagos islands

Name of Island: Galapagos Islands

Topic: Culture and Economy

Author: Birgitta van de Vorst (birgittavdvorst@hotmail.com, 10408878)

Amount of words: 3152

1.2 Introduction and relevance

The Galapagos Islands form an archipelago, which lies in the Pacific Ocean and consists of approximately 123 islands, of which also islets and rocks (Snell et al., 1996). There are 15 islands that are being considered as the main islands and they each cover at least 1km² of land. When Ecuador claimed the islands after its independence from Spain in 1822, they couldn't convince anyone to go live there. Most of the land wasn't suitable for farming, there were no opportunities for mining and even fishing was dangerous because of currents. Besides that, there lived a lot of animals on the islands that people had never heard of and there were told stories that they looked like monsters.



Nobody wanted to move there, so Ecuador decided to send prisoners and guards to the islands that had fresh water (San Cristobal, Isabela and Floreana). Years after, the descendants of the prisoners and some refugees from Europe were making a living on the islands. It was by the 1950's that there were grown villages on the islands, where people mostly lived from fishery. Also, tourism began developing around the 1970's and has only been growing since (Kenchington, 1989).

Figure 2. Map of the Galapagos Islands. Source: http://caltech.typepad.com/caltech_as_it_happens/senior-spotlight-ketaki/

This paper will focus on tourism on the Galapagos islands. It is very interesting that there has been such an increase of tourism on the Galapagos islands the past years. How did it impact residents, the economy, culture, animals and ecosystem? This paper will mainly focus on the impact of tourism on the social- and economic aspects of the Galapagos Islands and will provide new insights for authorities and other stakeholders. And there is another reason to discuss especially the impact of tourism on the social and economy. Something that stands out is that a lot of the academic articles that can be found about tourism on the Galapagos Islands, have a focus on the ecosystem. The goal of this paper on the other hand, really is to deepen the topic of the social and economy, and make a link between the two. To provide a clear structure in this paper, the topic will be discussed based on a research question and some sub-questions.

The research question is as follows; ‘what are the most important changes that took place on the Galapagos islands because of the tourism industry, focused on social- and economic aspects?’. To deepen the subject out, the analysis will then be done based on three sub-questions. They are as follows: - Sub-question 1: ‘what has been the impact of tourism on population growth?’

- Sub-question 2: ‘what has been the impact of tourism on the employment?’

- Sub-question 3: ‘what has been the impact of tourism on the prosperity?’

1.2 Analysis of island and topic

As already briefly discussed in the introduction, the Galapagos islands have a unique history when talking about its residents. The residents existed of prisoners and guards in the first place, later on it was their progeny and a small group of refugees from Europe who lived on the islands. The islands therefore have no indigenous people, which is quite unique. With the upcoming tourism really beginning in the 1970’s a lot has changed for the residents of the Galapagos islands (Epler, 2007). Where before 1970 the Galapagos were almost unreachable, nowadays the island is accessible per airplane or ship. There are several companies who offer cruises and an average of 6 flights per day shuttle between the Galapagos and the mainland. Because of this, a lot has changed in the social and economic sphere as well. The goal of this analysis is to get a good overview of the history and development of tourism on the islands, and thereafter, what the impacts of this tourism are on both social and economic aspects. First of all, an overview of the history of tourism on the Galapagos islands will be given, second we will discuss social aspects in relation to tourism on the islands and the third header will be about economic aspects in relation to tourism.

Tourism history

In a relatively short period (since people were living on the Galapagos islands until the 60’s) people were used to be self-sufficient on the islands. They were mainly living from fishery and agriculture, with almost no connections to the mainland. With the establishment of the Charles Darwin Foundation in 1959 this was going to change, a large part of the Galapagos became labeled as national park. This caused a prospect of possible upcoming (eco)tourism and economic development, so authorities as well as local residents were very supportive (Epler, 2007). But no one envisioned at the time, that the Galapagos islands would become one of the most visited ecotourism places in the world. By the late 1960’s there were two flights per week and several cruises to the islands. But it was the 1970’s that a lot of people see as the years that the tourism on the Galapagos really makes its start. By 1970, 4500 visitors were visiting the islands (Broadus et al., 1984) and in 1974 this amount of visitors was already grown to 7600 (Arcos et al., 1988).

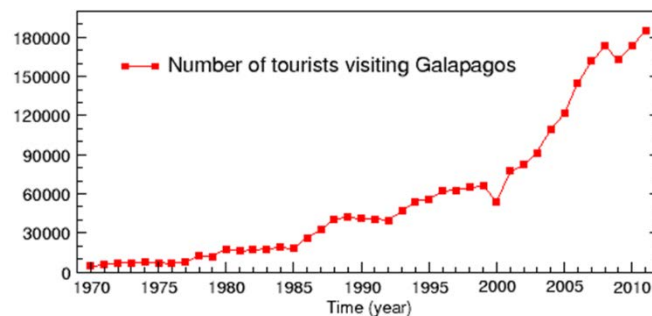


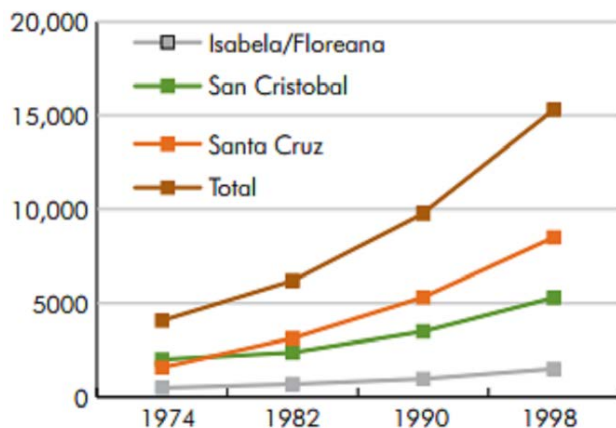
Figure 3 Number of tourists visiting Galapagos. Source: <http://jasss.soc.surrey.ac.uk/17/1/14.html>

In the late 70's the government made guidelines for the maximum amount of visitors accepted per year in the national park area, and the Galapagos were officially classified as World Heritage Site in 1979. This was necessary, according to the authorities, because the invasion of tourists threatened the ecosystem. Despite the restriction of 12000 people allowed to visit the national park per year, there were 18000 people who entered the park in 1980 (Epler, 2007). This is a good example of the unpreparedness for this suddenly upcoming tourism climate, which needs some good management. Between 1985 and 2000 there was, again, a big increase of visiting numbers to the islands (Epler, 2007). And as we can see in Figure 2, this increase has continued.

Social aspects

As well as the number of visitors, the people living on the Galapagos islands also increased from a couple of hundred in the late 1940's to around 6000 people in the early 1980's (Broadus et al., 1984). The average growth of people on the archipelago between 1974 and 1997 has been around 6% per year, that is three times more than on the mainland of Ecuador (Kerr et al., 2004). In figure 3 this growth is clear to see. Nowadays, we can speak of about 26000 inhabitants on the islands of the Galapagos archipelago. On Santa Cruz, the growth has even been bigger, because as being the capital, it became

Figure 9. Total and by Island Population Growth, 1974-1998



the main center of all tourism. This growth has been immensely, mainly because of its rapid development. The original residents, government and remainder had to anticipate very quick on these changes. To give some simple examples; all those thousands of people more on the island need to live somewhere, have food, need medical care and want to educate their children. So with the coming of these people, the social organization on the islands was the first thing to change (González et al. 2008).

Figure 4. Total and by Island population growth. Source: (Epler, 2007)

A great contribution to the population growth has been immigration. Approximately two-third of the population growth between 1974 and 1998 was due to immigration (WWF, 2003). A note to this is, that not all of the immigrants planned to stay forever on the islands. Some of them just came working for a few months or years and then returned back to their families on the mainland. The Galapagos islands became an attractive place for a lot of Ecuadorians with its upcoming tourism industry that caused a lot of employment opportunities in the late 70's. The image of the Galapagos islands as a place where prisoners were send to and people lived with minimal resources slowly changed. Still, in the 70's the electricity on the island was only available from 6-7 AM and 6-9PM, in the weekends there was two more hours of light in the evening (Epler, 2007). The infrastructure on the islands also lagged in development compared to the mainland of Ecuador, the roads consisted of mud and the highlands were only accessible by horse or foot (Epler, 2007). It was by the 80's that there were big improvements in the infrastructure and public services on the islands.

Besides some positive consequences of the growth in tourism and immigration, there were also rising conflicts because of the new situation. Some people feared the conservation of the national park as others feared that if the immigration would grow further, the new residents would take a lot of employment away for its original residents. This led to the Galapagos Special Law in 1998, which composed a list of guidelines to deal with these problems. For the past years, this restrained the issues, but not solve them. Some examples of restrictions that were made by the Special Law, are the raise of fees to enter the national park and to make it more difficult for immigrants to get a job. This led to a small reduce of immigrants per year, but it still kept on growing. If the population keeps on growing as it did the past years, the population on the Galapagos islands will reach a number of 118.000 residents in the year 2030 (Epler, 2007). This, of course, will lead to more and greater issues. In 2008 there were around 8000 undocumented people permanently living on the island, looking for a job (CoHA, 2009). The Special Law makes it more difficult for immigrants, especially undocumented, to get a job. People from mainland Ecuador still keep coming to seek for a better quality live. The Galapagos islands have better quality schools, in comparison with the mainland, almost no crime and the average salary is better (if you get a job). So if we compare the situation as it is now, with how it was at the start of this tourism outburst, it seems that the limit has reached.

The Galapagos islands have always been known for their 'untouched' nature and diverse biological life. Besides the issues discussed above, a couple of other problems have occurred as well the last couple of years. These problems have to do with sustainability and are correlated to the increase of the tourism industry. For example, the consumption of fuel on the islands has increased with an average rate of 8.2% since 1997 (González et al., 2008). Problems with the sewerage are occurring, drinking water is in process to pollute and the agriculture and fishery can't provide enough food anymore for all the people on the islands (Epler, 2007). Another concern is that many of the rural lands that used to have an agricultural purpose are now being transformed to places for residential housing (Kerr et al., 2004). Alongside these environmental problems, social and institutional instability is occurring. Social conflicts that have to do with management decisions and resource use for example, increased over the past years. Also fisherman riots are common nowadays (González et al., 2008).

A committee of the UNESCO world heritage discussed a number of issues on the Galapagos islands in 2010, and sought for solutions. In their report they discuss six main causes for the recent problems, of which tourism is one of them. The growth of tourists visiting the Galapagos islands is still overwhelming in 2010. Authorities responsible for tourism and conservation were still struggling to create a common vision on a tourism management strategy and system. The main advice from UNESCO therefore was to create a plan for regulation of tourism. In 2010, no authority was in charge of anything that had to do with supervising the tourism industry. Recently authorities regulate new projects regarding the constructing of new infrastructures, made a policy for 'sport fishing' and aim to improve the self-sufficiency of residents by agriculture (IBP, 2015).

Economic aspects

With the arriving of cruise ships and flights, employment started to expand on and around the Galapagos islands. Residents would independent offer catering and housing to visiting tourists, drive them around the island or give guided tours through the national park. Besides fishing, agriculture and commerce, tourism also became a stable source of income for some of the residents of the Galapagos islands. But when the number of visitors and immigrants really began to expand from the late 70's, entrepreneurs saw opportunities in the Galapagos and began starting businesses. Restaurants and

hotels were build, which provided more employment opportunities for the residents. The employment was becoming really good in the 80's and people from the mainland were noticing it as well. While at the mainland in Ecuador at a lot of places the unemployment was 25% and the underemployment was also 25%, on the Galapagos islands there were jobs for everyone (Central Intelligence Agency, 1998). This, and the fact that tourism was still growing, gave people who were thinking of coming to the archipelago a stable prospect. As we learned in the previous paragraph the immigration started increasing and the population on the islands started growing. There seems to be a question about who made the most profit out of the upcoming tourism industry, the original residents of the archipelago or the immigrants. Several people investigated and wrote about it, but it seems difficult to connect conclusions to this question. Overall, most of the companies providing transport between the islands and the mainland are owned by mainland Ecuadorians or foreigners. According to Epler (2007) 37 out of 42 hotel owners said to be living on one of the Galapagos islands. These two examples draw the image that not only the authentic residents are making a profit out of the tourism industry. Until recent days this is a much discussed topic, but still without clear answers.

Table 14. Direct Employment by Sector of the Tourism Industry, 2006.

Employment Sector	Santa Cruz	San Cristóbal	Isabela & Floreana	Total
Tour Agencies	72	18	7	97
Lodging	244	71	40	355
Restaurants, Bars, Etc.	225	102	50	377
Tourist Vessels*	870	230	0	1,100
Guides**				303
Total	1411	421	97	1929
Percent	73%	22%	5%	100%

* Excludes on-island employees.

** The locations of guides are not known.

Sources: Personal interviews; surveys; Ministerio de Turismo, 2006

Nevertheless, the Galapagos islands had one of the fastest growing economies in the world between 1999 and 2005. The total income at that time in the archipelago increased with 78% (Taylor et al., 2009). While the main force behind this growth was the tourism industry, other components which stimulated the economy were the government, conservation and fishery. In the year 1999, already 40% of the population of the archipelago was employed in the tourism sector (Wilen & Stewart, 2000).

Figure 5. Source: (Epler, 2007)

Figure 4 shows the direct employment by sector of the tourism industry in 2006. However, it is likely that there are a lot more sectors of employment in the tourism industry or sectors that are connected to the business. This includes earning money with selling souvenirs, drinks, food or other small items to tourists, or for example offering homestay. It is clear that the arrival of tourism has had a big impact on the employment on the Galapagos islands.

How about prosperity? Earlier on we already questioned if the residents were able to make profit out of the great upcoming tourism industry. It seems to be that on that question we don't get a clear answer. Bit since the tourism industry developed, it was clear that it had a positive influence on things as providing electricity, public services and infrastructure, which can also be considered as part of

prosperity. But a recent study of the Ecuadorian government shows that 31% of the residents live in poor conditions (<http://www.bbc.com/news/world-latin-america-22812108>). It is also notable that since the beginning of tourism growth, the level of wealth differs per island. From the first moment the tourism industry was rising, Santa Cruz has been leading in levels of prosperity.

In areas such as infrastructure, the quality and diversity of services and tourist dependent businesses, Santa Cruz still has a leading role (Epler, 2007). So the prospect people had at first, that the upcoming tourism industry would provide growing prosperity on all inhabited islands, did not become reality. This also applies for the providing of good public services like schools. In 2010 more than 40% of the adult population had only had basic schooling or no schooling at all (<http://www.bbc.com/news/world-latin-america-22812108>). Still, these numbers are relatively, because on the Ecuadorian mainland these numbers are even higher. This is also the case if you compare some other facts that have to do with wealth or public services. On the mainland the circumstances are usually always poorer (Epler, 2007).

1.3 Conclusion

The goal of this paper was to first of all get a good overview of the history and development of the tourism industry on the Galapagos islands. And second, the main research question was to find out what have been the most important changes because of the tourism industry, focused on social- and economic aspects. Looking at the sub questions, it was clear that there was going to be a focus on people. The sub questions consisted of what has been the impact of tourism on population growth, employment and prosperity. The topics discussed in the analysis are mainly related to the people living on the Galapagos islands; topics are about their work, their environment, their growth and their struggle with additional issues.

In the course of this study, it became clear that the sub questions were too limited. Namely, the coming and growth of the tourism industry on the Galapagos islands has been steering for the daily lives of the residents. But because of the scale of this study, we tried to stick to the topics. First of all, it has changed the main drive of people's income and daily work. The fishing and agriculture were the main sources of income for the people living on the Galapagos at first, but later this became the tourist industry. This is one of the first big changes the tourism brought to the residents of the Galapagos islands. Second are the changes that followed because of the available money for innovation and improvements. For example, the installation of electricity and better roads and the improvement of education and medical care. As a result of these developments, the immigration of people from the mainland and beyond increased. For them, the living conditions and work opportunities were much higher on the Galapagos than where they came from. But these relatively positive changes also have a downside. For example, the pollution and disturbance of nature reserve and ecosystems. The population and numbers of visiting tourists are still growing, and create an overload to the islands.

If we look to this from a broader perspective, other islands can learn from this situation. The people on the Galapagos islands were not prepared for these changes to come and therefore didn't have a good plan to deal with these changes. Tourism management and government regulation in these kind of situations are very important. But it is the unexpected element of this suddenly explosive growth, that didn't give people the time to adapt and deal with the new situation. Therefore, it is interesting to take this study to a next level and investigate whether islands can be prepared for this kind of changes.

2. Sustainability of giant tortoises

Name of Island: Galapagos Islands

Topic: Ecosystems and Species

Author: Wouter Borg (wouterborg@hotmail.com, 10801081)

Amount of words: 3162

2.1 Introduction

The Galapagos tortoise (*Chelonoidis niger*) is the biggest tortoise-species on earth. They only live on the Galapagos archipelago, about 1000 km from the coast of Ecuador. They can reach ages beyond one hundred years and they can weight about 400 kg. The maximum length of the shell is one meter. In the Galapagos archipelago live 95 endemic vertebrate species (www.galapagos.org). This is because the archipelago lies thousand kilometers from the coast of Ecuador and so they are almost isolated from the mainland. These islands have never been connected to the mainland because they are volcanic islands and are created in the middle of the ocean. The few species which did came on the archipelago arrived a very long time ago and developed apart from their ancestors from the mainland. Because the island archipelago exists almost five million years the animals have adapted to the specific circumstances on the islands and have become new species. Even on the different islands of the archipelago are different circumstances and differ the animals on the various islands so much so that they have become different species.

The first one who noticed all of these species have developed from one common ancestor was Charles Darwin. He visited the Galapagos archipelago in 1835 with his ship the Beagle. The animals he studied, and most the finches, were the origin of his ideas of evolution. Another example of the different species are the eleven species of the giant tortoise on the Galapagos archipelago, each live on their own habitat. There were even more species, but they are extinct. The other giant tortoise species were also very close to extinction. These aspects come back later in this paper. They are not extinct yet and it is important that they survive, because of several reasons. First of all, the giant tortoise is a key species in the ecosystems of the Galapagos (Gibbs et al, 2010).

The conservation of the ecosystem of the Galapagos is important to keep the biodiversity high. The whole Galapagos archipelago is UNESCO world heritage. Therefore, it is important to make sure the giant tortoises do not extinct. The second reason to conserve the tortoises is its important role for the tourism of the archipelago. The tortoise is the symbol for the Galapagos islands and for many tourists a reason to visit the islands. The third reason is the meaning of the tortoises for science. In general islands are an important study object for evolutionary processes (Emerson, 2002). Because the island has been isolated for many years from the mainland the tortoise and the whole ecosystem around it are an important study object for evolutionary processes and a good example for studying how ecosystems react to change, for example the influence of humans. Thus it is important for both scientific, ecological and economic reasons that the giant tortoise do not extinct. Therefore, the main question of this paper is whether the population of the giant tortoise is sustainable on the Galapagos archipelago. The main question will be answered by a past, present and future analysis. In the first chapter, the past, the

history of the giant tortoises on the islands will be discussed until about 1970, which was a turning point, because important measures were taken. After that there will be looked on the present situation, this is the period from 1970 till now. After this will be tried to describe when a population of tortoises is sustainable. For this we will use the concept of the minimum viable population. And finally will be discussed what needs to be done in the future to get a sustainable population of giant tortoises on the Galapagos archipelago.

2.2 Analysis of the island: past

The Galapagos archipelago are volcanic islands, they were 'made' in the ocean and thus they have never been connected the mainland of South America. The archipelago is less than five million years old, which is relatively old. The tortoise came to the archipelago from the mainland. The most related living tortoise of the Galapagos tortoise is the *Geochelone chilensis* which lives in Bolivia, Argentina and Paraguay (Caccone et al, 1999), see figure 2. This relative small tortoise's shell can be up to 40 cm long. But this is probably not an ancestor of the Galapagos tortoise. The giant tortoise lived in the Pleistocene on almost all continents of the world (only not in Australia and Antarctica). The giant tortoises survived only in several oceanic archipelagos. Now they live only on the Galapagos Islands and on the Aldabra atoll in the Seychelles. So the *Geochelone chilensis* and the *Chelonoidis niger* have a common ancestor, as shown in figure 1. However, due to climate change and overhunting by humans the giant tortoise became extinct on the mainland (Cione et al, 2003). On the oceanic islands were no humans and other big predators, so the tortoise could survive there.

The tortoise population of the Galapagos archipelago has been greatly affected by human action since its discovery in 1535 by a Spanish ship. The Spanish named the island Galapagos, after the Spanish word for tortoise (Galapos), because there were so many giant tortoises. In the following centuries many tortoises were killed and eaten by the crew of passing ships. It is estimated that over 200 000 tortoises were killed in this way (Pritchard, 1996). With these ships came invasive species like black rats on the island. These black rats were also a threat, because they preyed on the eggs and juveniles of the tortoises. Another threat for the tortoises came from the settlers who came on the island archipelago in the nineteenth century. They hunted the tortoise for food and tortoise oil. But maybe even bigger threat that came with these settlers were the goats and donkeys they introduced on the island for cattle breeding. In 1971 for example there were an estimated 30.000-40.000 goats on the Island Santa Cruz. These animals competed for food with the tortoise and cause damage to the vegetation, which greatly influenced the population of tortoises (Macfarland, 1974).

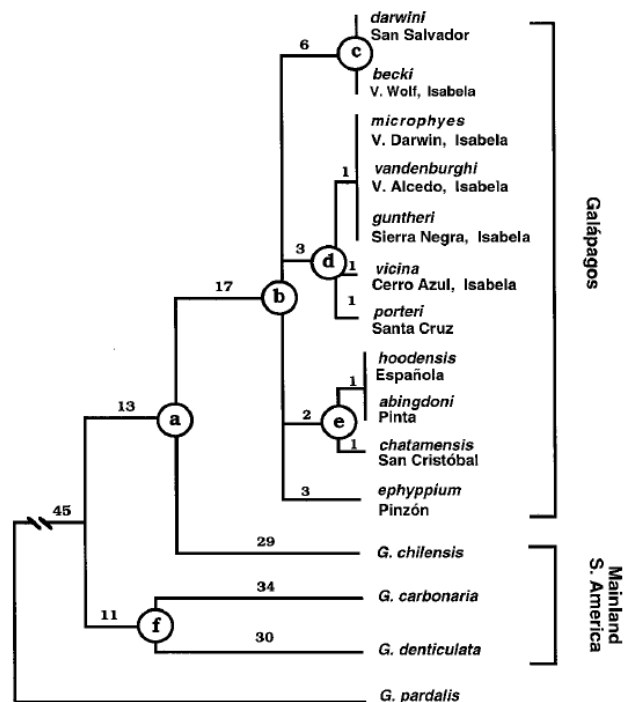


Figure 6. Phylogenetic tree of land tortoises, based on studies on DNA. The relationship between the different tortoises on the Galapagos archipelago and the mainland of South America is shown (Caccone, 1999).



Figure 7. Map of South America, including the Galapagos archipelago which is enlarged in the left corner. Some different species of tortoises are pictured at the current habitat. The tortoises are on scale with each other (Caccone, 1999)

2.3 Analysis of the island: present

In the last few decades there were some projects to measure the effects of the invasive species on the population of giant tortoises and to investigate if it is possible to reduce these effects. In table 1 are the numbers of the various species of giant tortoises shown. Around 1974 the populations reached a minimum. It is notable that all populations have greatly increased since then. For example, the *Geochelone vandenburghi* has much increased. One reason for this is probably the extinction of the goats on the volcano by the project Isabella. In this project the effect of goats on the tortoise population has been measured by the Alcedo Volcano on the island of Isabella. From 1995 till 2006 the project removed over 62.000 goats from the Volcano. The feral goats were eventually eliminated in this area. During this period, the effects on the tortoises were measured. There was also a control group on the island of Santa Cruz, where no goats were removed. The changes in this group tortoises were also measured. As a result, by the Alcedo Volcano there was a sharp increase of young tortoises, while on Santa Cruz there were no significant changes in the population (Marquez, 2013). On the Alcedo volcano lives the *Geochelone vandenburghi*. A same kind of project was done on the island of Santiago, where in total 18.000 pigs were killed. Since then there are no pigs anymore on Santiago (Cruz, 2004).

However, almost all the species are greatly increased in numbers since 1974. Around 1974 the total population of giant tortoises on the Galapagos archipelago reached a minimum about 3000 animals. Some tortoise species were already extinct by then. Other species were very close to extinction. Between 1974 and 2010 several measures were taken. In 1960 the Galapagos archipelago became a National Park of Ecuador. In 1965 the National Park began with protecting programmes. They also opened a breeding centre, named Fausto Llerena Breeding Centre, where they nurture new born tortoises of the most endangered species which they take from the nests. So they can protect the little tortoises when they are the most vulnerable. When they are about 20 cm they are repatriated in the wild. As a results of the breeding programmes, the survival rate has improved. Now there are 1000 tortoises in this Breeding Centre and they have made a few more Breeding Centres on other islands. In total over 6000 giant tortoises have been repatriated in the wild.

Species	Number of tortoises in 1974	Number of tortoises in 2009/2010
<i>Geochelone becki</i>	0	1139
<i>Geochelone microphyes</i>	65	818
<i>Geochelone vandenburghi</i>	402	6300
<i>Geochelone guntheri</i>	219	694
<i>Geochelone vicina</i>	196	2574
<i>Geochelone pateri</i>	+/-1400	3390
<i>Geochelone hoodensis</i>	15	860
<i>Geochelone chathamensis</i>	213	1824
<i>Geochelone darwini</i>	+/-380	1165
<i>Geochelone abingdonii</i>	1	1
<i>Geochelone ephippium</i>	100	532
Total	3060	19317

Table 1. In this table the numbers of the various species of giant tortoises on the Galapagos archipelago are shown for 1974 and 2009/2010. This data comes from a monitoring program of the Galapagos National Park (Parque Nacional Galapagos Ecuador).

Minimum Viable Population Size

In biology, one way to describe whether a population is sustainable or not, is the minimum viable population size (Shaffer, 1991). The definition of the minimum viable population is given by Shaffer (Shaffer, 1991): 'A minimum viable population for any given species in any given habitat is the smallest isolated population having a 99% chance of remaining extant for 1000 years despite the foreseeable effects of demographic, environmental, and genetic stochasticity, and natural catastrophes.' With natural catastrophes are meant events such as fires, droughts of earthquakes. Genetic stochasticity means the fluctuation of different genes as a result of genetic drift and inbreeding. Environmental stochasticity means effects on the population of the variation of the habitat parameters such as diseases and predators. Demographic stochasticity means the variation of the population due to the reproductive success of individuals.

In the article of Shaffer in 1981 the minimum viable population was introduced for the first time. After this there has been much more research about the concept and the use of the minimum viable

population (Traill et al., 2007; Frankham, 1995; Reed et al., 2003). The definition of minimum viable population has also been changed very often, especially the chance of the population to survive the defined period. This period is also variable between the studies. This is often set on 40 generations instead of 1000 years (Traill, 2007). Also many research is done to determine the minimum viable population of specific species (Fagan et al., 2001, Traill et al., 2007). Traill et al. (2007) has done a meta-analysis on these studies with the purpose to determine a general median minimum viable population size for all species. In this study the minimum viable population was defined so that the population would survive for 99% over 40 generations. Based on 141 studies with a total of 202 species they found the median of the minimum viable population size of 4169 individuals (Traill et al., 2007). They also found a median for different groups of species, such as birds, mammals and herptiles (reptiles and amphibians) as shown in table 3. In this research no study on the minimum viable population of giant tortoises was found. However, to get an estimated number for the minimum viable population for giant tortoises we take the median for herptiles from this study as basis. Traill et al. (2007) found for this median 5409 individuals. There have been more studies which try to determine a median for the minimum viable population size.

Reed et al. (2003) studied the minimum viable population size of vertebrates. They used the data of 102 species. For which they determined the minimum viable population to survive 40 generations with 99% chance. They came on a median of 5816 individuals. They also found that the taxa and the climate does not influence the minimum viable population size. For example, in table 2 different tortoises are listed with their estimated minimum viable population size. This shows the differences between tortoise species. There was a negative correlation with population growth speed. However, the use of minimum viable population size is controversial among some scientists (Flather, 2011; Brook et al., 2011). The biggest points of critics are that the minimum viable population generalizes between all sorts of species in different circumstances (Flather, 2011).

Species	Minimum viable population size
Caretta caretta	9472
Chelydra serpentina	6779
Chrysemys picta	7594
Emydoidea blandingii	1856
Kinosternon subrubrum	18636

Table 2. Different tortoise species with their minimum viable population size estimated by Reed et al (2003).

	n	MVP _{st}
Vertebrates		
Birds	48	3742
Fish	8	1,239,727
Mammals	95	3876
Herptiles ^a	31	5409
Sum/median	182	4102
Other taxa		
Plants ^b	22	4824
Insects	5	10,841
Marine invertebrates ^c	3	3611
Sum/median	30	6111
Body mass		
<1 kg	98	5137
≥ 1 kg	114	3956
IUCN		
Listed	92	3611
Not listed	120	4824
All species	212	4169
a Reptiles and amphibians.		
b Mosses, ferns, dicotyledons, monocotyledons and gymnosperms.		
c Molluscs and crustaceans.		

Table 3. In this table an overview of the minimum viable population estimated by Traill et al. 'n' Stands for the number of studied species and MVP is the estimated minimum viable population size. For the herptiles this size is 5409 individuals (Traill et al., 2007).

2.4 Analysis of the island: future

In the previous paragraphs we discussed the history of the giant tortoises' populations on the Galapagos archipelago, the size of the present populations and the measures taken to protect the populations and to make them more sustainable. Also we discussed the minimum viable population size in general. In this paper we discuss whether the populations of giant tortoises on the Galapagos archipelago are sustainable. Therefore, in this chapter we will combine the information of the previous chapters to try to answer this main question and discuss the measures that have to be taken in the future in order to reach and conserve a sustainable population in the future. First there will be made a rough estimate for the minimum viable population size of the giant tortoises on the Galapagos archipelago. This estimation will be based on the information discussed in the previous chapters. After that we will discuss whether the size of the present populations is bigger or smaller than the estimated minimum viable population size. Finally, we will discuss what measures should be taken.

There is no minimum viable population size determined for the giant tortoise. Because we have to know this number to be able to determine whether the population is sustainable or not, we will make a rough estimation of the minimum viable population based on other studies on minimum viable population sizes. As a result, the estimation is not very accurate and not definite. As seen in the last chapter Traill et al. (2007) found in their meta analyse for the minimum viable population a median of 4169 individuals. Because there was a difference between birds, mammals and reptiles and because the tortoise belongs to the last group, we will take the median of that group: 5409 individuals. The study of Reed et al. (2003) found a minimum viable population for vertebrates of 5816 individuals. They estimated the mean minimum viable population size on 7000 individuals because the study length was

too short and they corrected for this. The minimum viable population size based only on the conservation of genetic diversity was estimated on 4500 individuals (Franklin, 1980) However, the giant tortoise of the Galapagos has a number of specific characteristics that possibly influences the minimum viable population size. Reed et al. (2003) found a negative correlation with the growth rate of the population. The grow rate of the tortoises is very slow compared to other species, because they live very long and reach sexual maturity at a relative high age. Therefore, the minimum viable population could be higher than the median. Another aspect that could influence the minimum viable population size is the islandness of the Galapagos tortoise: the fact that he lives on an isolated island in the absence of predators. As a result, the minimum viable population could be lower than the median. With these numbers in mind we could make the rough estimation that the minimum viable population size of the giant tortoise probably lies between 4000 and 7500 individuals.

Looking to the total number of giant tortoises on the Galapagos archipelago, 19317 (table 1), it seems the tortoise population is quite sustainable. However, the population exists of 11 different species. Looking at the numbers of these different species (table 1) probably only 1 specie, *Geochelone vandenburghi*, might be sustainable (6300 individuals). The numbers of individuals of the other species lie all below the estimated minimum viable population size. Without help of humans there will be a decent chance for them to extinct. To make the populations sustainable their numbers must increase. There are several measures that can be taken to achieve this. The population of the *Geochelone vandenburghi* was in 1974 also smaller than the minimum viable population (402 individuals, table 1). Probably the most important measure taken on the island of *G. vandenburghi* was the removal of feral goats by the project Isabella (Marquez, 2013) as seen in the paragraph about the present. If the feral goats, donkeys and pigs on the other islands will be removed, the numbers of the populations on these islands will probably also increase. Also, the protection program which made the breeding centres must be continued or even intensified until the populations reach their minimum viable population size.

2.5 Discussion

Because there was no study on the minimum viable population size of giant tortoises, there had to be made a rough estimation. The universal use of the minimum viable population size is controversial (Flather, 2011; Brook et al., 2011). The estimation made in this paper is not based on direct research on the giant tortoises, but on a comparison of the known minimum viable population sizes, so this can be doubted. Further research should directly research these giant tortoises and improve the estimation. Also there should be looked whether the habitat of the tortoise is sustainable. This is beyond the scope of this paper, but it is very important for the sustainability of the giant tortoise.

2.6 Conclusion

The main question of this paper is whether the populations of giant tortoises on the Galapagos archipelago are sustainable. In this paper we roughly estimated the minimum viable population size of this population on 4000-7500 individuals by comparing the known minimum viable population sizes from the literature with each other. All population-sizes except one lie under this estimated range. Probably only the *G. vandenburghi* is sustainable at the moment. To make the other species sustainable some measures have to be taken, like the removal of feral goats, pigs and donkeys on the Galapagos archipelago. However, the estimated minimum viable population size is not based on direct research on the giant tortoise and this should be done in following research.

3. Development and biodiversity

Name of Island: Galapagos Islands

Topic: Ecosystems and Species

Author: Cynthia van Leeuwen (cynthia.vanleeuwen@student.uva.nl, 10767924)

Amount of words: 3117

3.1. Introduction

The Galapagos islands, also known as Las Islas de los Galápagos, the island of the Tortoises, by the visiting nationals from Ecuador (Wiggins & Porter, 1971). It is an archipelago of volcanic islands, that is located on the west side of the continent of South America and is part of Ecuador. The archipelago, which is shown in figure 2, consists of 14 large islands and several smaller islands, rocks and islets (Eckhardt, 1972). The islands are distributed along the equator, but most of them can be found in the



southern hemisphere.

Figure 8 The Galapagos islands.
Retrieved from Galapagos Last Minutes (n.d.)

Figure 9 Plate tectonics. Retrieved from
<http://people.rit.edu/rhrsbi/GalapagosPages/Galapagos.html>

The formation of the Galapagos Islands can be explained by the process of plate tectonics. The islands are located on the northern edge of the Nazca plate. This plate is surrounded by other plates, with the Cocos plate in the north, the Pacific in the west, the South American plate on the east and the Antarctic plate in the south.

The theory of evolution was conformed due to the rich diversity of endemic species on these islands. Wiggins and Porter (1971) stated that 32.5 percent of the flora species could be qualified as endemic. Also, on the archipelago 77 endemic bird species and 10 endemic mammal species can be found. Of course many other endemic species can be found. What makes the Galapagos archipelago

extraordinary, is that fact that the ecological and evolutionary processes have remained quite untouched by humans (González et al., 2008).

The author states that the island has maintained this unique characteristic because of the absence of aboriginal populations and the late human colonization in the early 20th century. This means that the biodiversity has stayed relatively the same in the course of time. Eckhardt (1972) states that the islands have retained 97 per cent of their original species. More recent research shows a decline towards 95 per cent of original species (González et al., 2008).

This paper will combine the process of plate tectonics, paleogeography and the biodiversity of the Galapagos Islands. The research question is how the development of islands, due to plate tectonics and processes of glaciation, has influenced the development of ecosystems and their species on the Galapagos Islands. This will be done by making an analysis of the past, present and future of the Galapagos islands. The isolation, area and age of the islands will be addressed in order to research how these characteristics have influenced the development of species and the biodiversity of the Galapagos archipelago.

3. 2. Analysis: island past & present

3.2.1 Geographical history and age of the islands

In this paragraph the geographical history will be addressed, considering the process of plate tectonics and volcanism.

As stated before, the Galapagos Islands are located on the Nazca plate. Currently, the Nazca plate is moving in south-eastern direction with 5.1 centimeters per year, which means that it is colliding with the South American plate and at the same time, it is moving away from the Cocos plate and the Pacific plate (figure 4) (Angermann et al., 1999). At the boundary of the Nazca and the South American plate, a subduction zone can be found. The result of this movement is the formation of the Andes on the

west coast of South America.

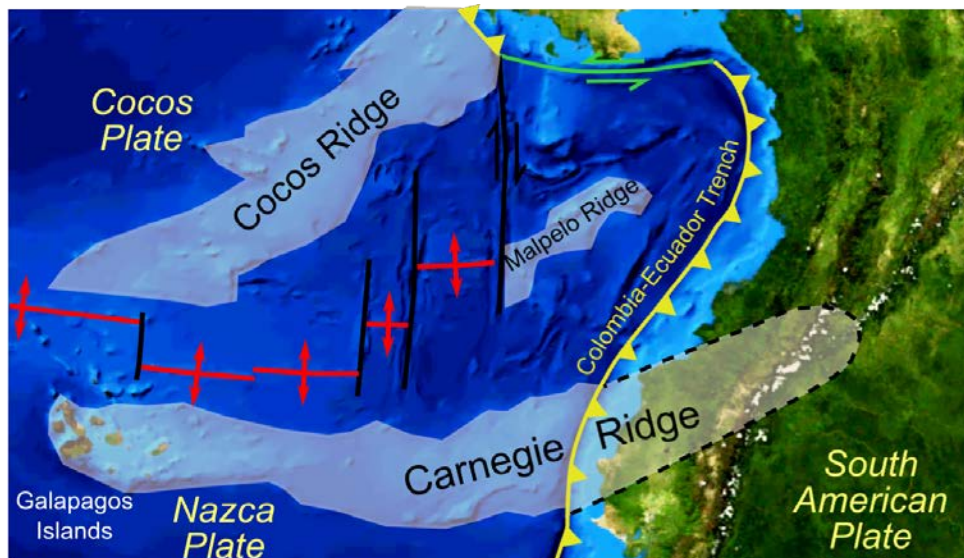


Figure 10 Plate tectonics Galapagos. Retrieved from http://www.wikiwand.com/es/Placa_de_Nazca

This movement has also resulted in the formation of the Galapagos islands, which are a highly volcanic island group. The Galapagos are the result of a hotspot. This means that there is a mantle plume in the oceanic crust which forms an underwater volcano. These hotspots grow bigger by accumulation of lava, until eventually they become an island. In the case of the Galapagos Islands, the south-eastern movement of the Nazca plate has resulted in the moving away of the first island, while a second island was formed by the same hotspot. In this way, the formed volcanic islands become inactive and process repeated itself, until eventually the Galapagos Islands were formed (Sutton, Manghni, Moberly & McAfee, 2013).

The Galapagos islands have been formed in situ, which means that these islands have never been connected to the continental mainland (Cowie & Holland, 2006). Also, because of the way they were formed, a gradient in age has appeared: the oldest islands can be found farther away from the hotspot. While moving eastwards, the age of the islands increases. The estimated age ranges between 3 and 5 Ma. But discussion over the true age of the Galapagos islands exists. By looking at drowned seamounts, Werner et al. (1999) states that the archipelago has been suitable for colonization for 14 million years.

The age of the Galapagos archipelago has an influence on the species richness of the islands. The younger an island is, the more space for development of an ecosystem is still available. In a pioneer ecosystem, many niches are still empty, which means that evolution of new species is enhanced. If a volcanic island is still active, parts of the island will return to a 'young' state, due to volcanic eruptions, in which species can evolve in order to fill the newly created niches. In a pioneer ecosystem a disharmonic biota can be found: it is not ecologically saturated and has therefore empty niches. Disharmony enhances adaptive radiation of species, so speciation will appear (Menken, 2015).

3.2.2 Distribution species from the continent

As described in paragraph 2.1, the Galapagos were formed in situ. The archipelago, located 900 kilometers west of Ecuador, has never been in contact with the continental mainland. This has raised many questions about the origin of the Galapagos species.

By looking at the characteristics of the endemic species the dispersal across ocean barriers can be explained. The species that were found possessed long distance dispersal mechanisms that allowed them to cross this ocean barrier (Grehan, 2008). This explains why reptiles and birds are found dominantly, followed by a small number of mammals. On the other hand, amphibians are absent on the archipelago. The dispersal mechanisms are divided in two categories: active and passive. It is obvious to say that birds and mammals, such as bats, fly by themselves. But plants are adapted in a different way: wind dispersal, where a single spore or seed can cause colonization (Menken, 2015).

There are three tracks of migration that led to the distribution of species as can be found on the islands today: the eastern Pacific track, the Galapagos Caribbean track and the Pacific basin, which connect endemic species with their ancestors in North and South America (Grehan, 2008).

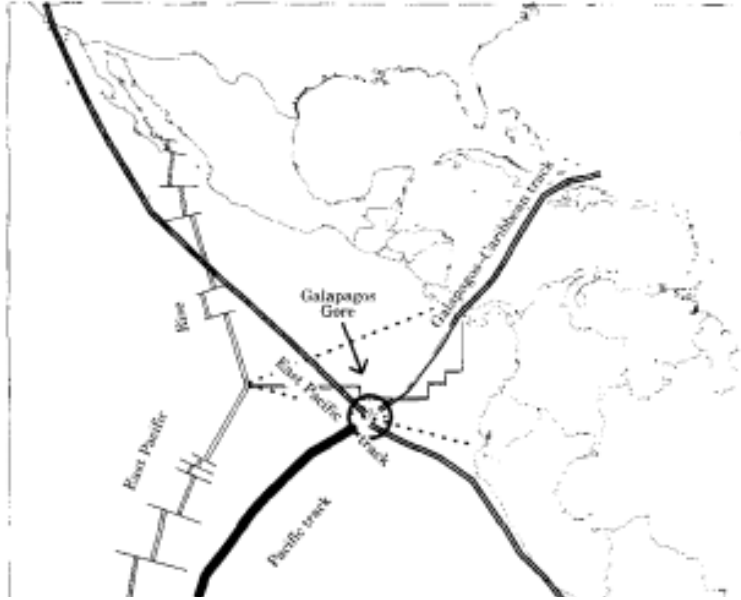


Figure 11 Connection Galapagos endemic species to ancestors. Retrieved from Grehan (2008).

This model is based on the principle that the transportation of material happened by the oceans and the wind, and that this has led to this biogeographical pattern.

3.2.3 Island dynamics

In this analysis there will be looked into the conditions that have made the Galapagos Islands such a suitable place for the settlement of species and how this has resulted in a rich diversity of (endemic) species. The influence of isolation, extinction, area and age of the island will be addressed in order to answer this question. These characteristics will be combined with the role of Pleistocene glacial cycles, which has shaped the present day biota of many islands.

By looking at the equilibrium theory of island biogeography of MacArthur and Wilson (1963), the relationship between immigration, speciation and extinction can be addressed. They explained with their theory that the number of species on an island is influenced by the immigration of species that originated from the continent and the extinction on the island. In other words, the extinction depends on the area from the island. On a larger island it is likely that there are more resources available for

species, which will result into small extinction rates.

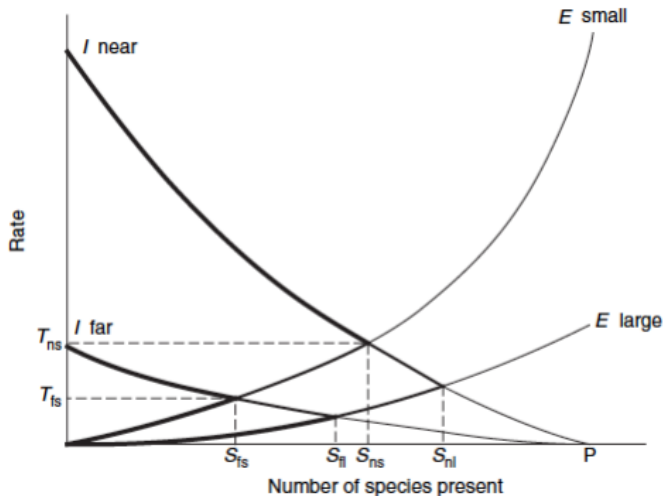


Figure 11. Equilibrium Theory of Island Biogeography. Retrieved from MacArthur and Wilson (1963).

The relationship can be explained by using figure 6. At first, the y axis represents the rate of colonization of the island and the x-axis represents the increasing species richness. If this figure was applied specifically to the Galapagos Islands, the following conclusions can be drawn. The Galapagos Islands are located 900km west from Ecuador, which means that the isolation will be high (*I* far). Because the mainland is the source of new immigrants, islands that are located far from the mainland will have less species, because they are harder to reach. Also, due to this decreased likelihood of immigration, extinction rates will be higher (Menken, 2015). Gillespie, Claridge & Goodacre (2008) stated that when an island is more remote, there is more adaptive radiation of species found. Remote areas have different environmental conditions. Often, there is a disharmonic biota that contains empty niches. This characteristic enhances speciation.

Furthermore, the islands have a combined area of 7880 km², which means that they have a relatively large area (*E* large). A bigger island is 'easier to hit' by chance than a small island. Also, as explained before, more resources are available. This will lead to a higher species richness (Menken, 2015). Concluded, with these conditions the Galapagos has a relatively high number of species present, but with a low rate of colonialization due to isolation. An explanation for the high biodiversity of the Galapagos Islands will be given in the next paragraph.

3.2.4 Influence of sea-level fluctuations

In the previous paragraph the general island dynamics theory has been explained. In this paragraph the influence of Pleistocene sea-level fluctuations will be addressed, which has resulted in many endemic species.

Since the Galapagos are very isolated at present, the influence of fluctuations in sea-level can help to find an explanation for the fact that the islands have a high biodiversity. In the Pleistocene, the sea level dropped for about 121 meters compared to the situation now (Fairbanks, 1989), which resulted in the appearance of shallow seas and more seawards located continents. In this way the islands that were previously isolated, became connected to the continent. Also, the islands were bigger (Rijsdijk et al., 2014).

The Galapagos Islands have emerged approximately 3 million years ago and have experienced 36 glacial-interglacial cycles. Harpp et al. (2014) state that the Galapagos have experienced a rise in sea level of about 6 to 9 meters (compared to the current situation) in the last glacial. This means that in the last glacial the islands were bigger and less isolated from each other, but also from the mainland. By looking at the past 20.000 years, the conclusion can be drawn that during the last glacial maximum, the total land area above sea level was bigger, which has resulted in connection of many islands. However, during in this same period of time, 4 islands and dozens of islets have sunken.

These fluctuations of the mean sea level on the geographical isolation had significantly effect on the amount of endemic species that can be found on the Galapagos Islands. It has changed the rate of immigration and extinction. This can be explained by the fact that with a bigger surface area and the alternation between sinking and rising of land bridges, the carrying capacity of the islands and the rate of isolation have changed. When there were land bridges between the islands during the Pleistocene, immigration between the islands could appear. However, the islands were not connected to the

continent in the Pleistocene, which explains why so many endemic species can be found (Fernández-Palacios, 2015).

By looking at a bigger time scale of fluctuations in sea level, Harpp et al. (2011) states that there were at least 19 Galapagos islands between 1 and 5 million years ago, which are now sunken.

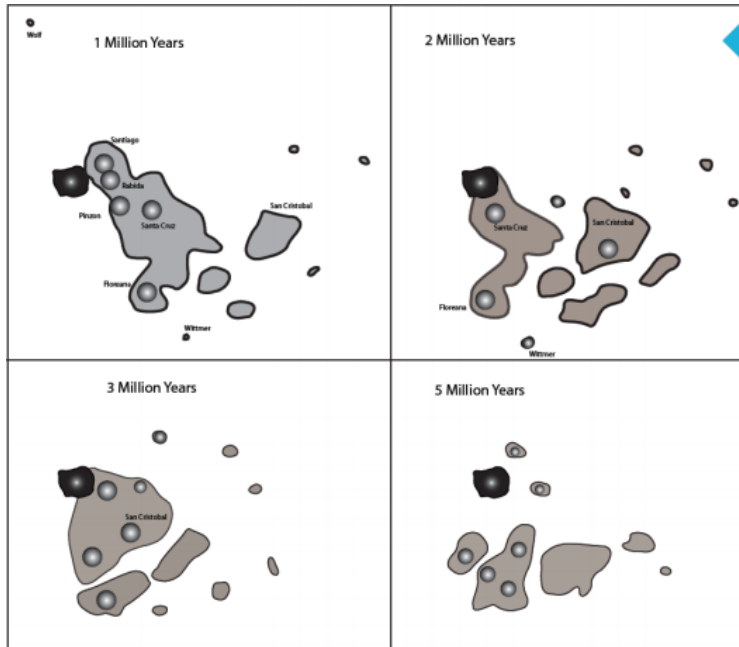


Figure 13 shows that 5 million years ago, there were 7 bigger islands to be found. The location of the islands allowed immigration of species. While 1 million years ago, some of these islands were already sunken and new islands emerged.

Figure 13 Island dynamics Galapagos past 5 million years. Retrieved from Harpp et al. (2014)

Concluded, with a lower sea level, due to glaciation, the rate of isolation is reduced, which results in a higher connectivity. In this case the rate of immigration between the island will increase, while the rate of extinction on the islands will go down. The bigger the surface area of the island, the easier it will be to reach it.

3.3 Analysis: Future

In this paragraph the population growth and tourism of the Galapagos will be addressed, which are both the result of an increased connectivity. Also, there will be looked into the possible consequences of these actors.

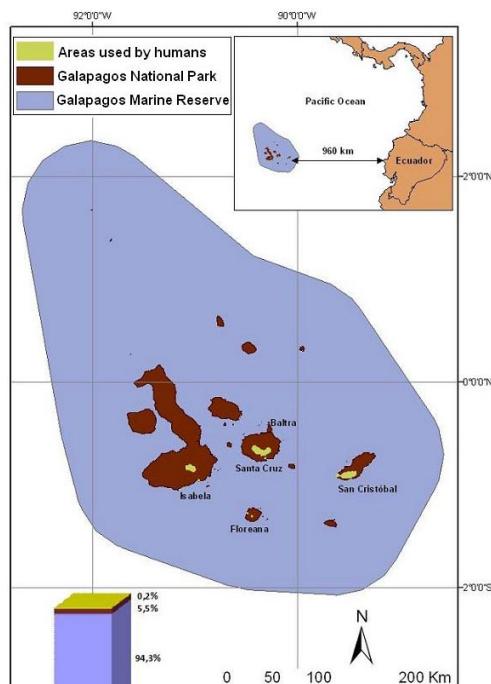


Figure 14 Division land surface Galapagos. Retrieved from González et al. (2008)

As shown in paragraph 2, the Galapagos islands are unique due to high biodiversity and presence of endemic species. The islands acted as a laboratory for studying the principles of evolution in the past, and it still does today. To protect this unique, nearly undisturbed ecosystem, nearly 97% of the land surface is recognized as a National Park (González et al., 2008). The exact division between protected areas, such as Galapagos National Park and Marine Reserve, and areas that are used by humans are shown in figure 8.

The problem that is faced today, is the coexistence between the population and the ecosystem of the Galapagos Islands. To maintain the unique ecosystem, the isolation of the island also has to be maintained. The species that are living on the islands, are used to the isolation of the relatively recent pre-human history (González et al., 2008). This isolation is a challenge to maintain, due to the increasing connectivity with the continental mainland and between the islands. In the past decades an increasing flow of people, goods and services have

appeared.

The resilience of the islands is stressed. Resilience is 'the capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly'. The Galapagos knows a high annual population growth rate, of 5.9% in the period of 1990 to 2001 (González et al., 2008). Mean reason for this growth is the (illegal) immigration from Ecuador. Expectations are that the population will double in the period 2017 to 2024 (González et al., 2008). With this growing population, more ecosystem services are needed to maintain the same quality of life, which will result in a growing pressure on the resilience of the ecosystem.

The increasing connectivity has also resulted in an increased number of alien species, which influence the ecosystem in a negative way. Many endemic species do not have defend mechanisms to these alien species. Therefore, the alien species can fill up the niches of the endemic species, which will become extinct.

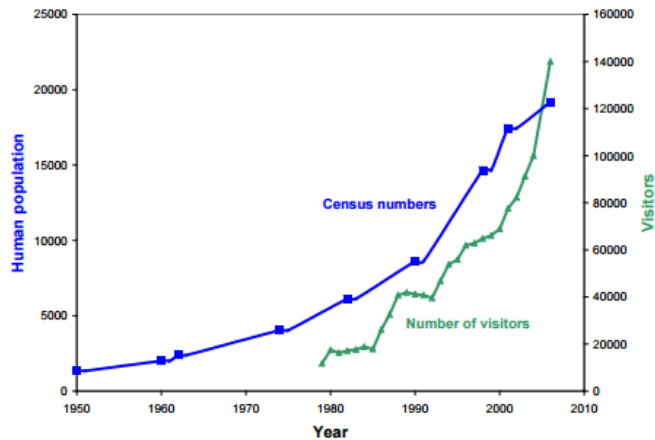


Figure 15 Growth Visitors and Resident Population. Retrieved from Taylor et al. (2006).

Another consequence of the increasing connectivity is the growing number of tourists that visit the Galapagos archipelago annually. The start of tourism can be found in the 1960s, where it started on a small scale, with approximately 2000 visitors annually. Over the years' tourism has increased by an average of 14% per year (Taylor et al., 2006). In figure 9 the increase of the number of visitors is shown. What is striking most, is the fact that in 2006 the number of visitors exceeds the number of residents.

With an increasing number of visitors every year, more and more land is needed to shelter them. Space is the limiting factor on islands, therefore the only way to obtain more land is to decrease the protected area. In this way the resilience of the ecosystem is even more stressed.

However, tourism in the Galapagos is not just regular tourism. In order to reduce and mitigate the negative impact of tourism as much as possible, ecotourism is performed. Research (Powell & Ham, 2008) shows that ecotourism has a positive effect on the point of view and attitude of the visitors, concerning environmental conservation. Also, part of the profit of the tourism sector is invested in the conservation of the National Parks. But even this ecotourism is under pressure. They have to refine their tourist concessions in order to increase benefit flows to the local population. Result of these new rules concerning the intensity of tourism that may occur in the National Parks, is economic benefit to the locals. However, this will not be sustainable on the long term, because the financial flow will only enhance growth (Watkins, G. & Cruz, F., 2007).

Concluded, it is important to maintain the ecosystem of the Galapagos Islands as close to its pre-human state as possible. Unfortunately, increasing connectivity puts stress on the resilience of the ecosystem. Population growth, higher tourist numbers and introduction of alien species has resulted in a decrease of isolation; the characteristic that makes the biodiversity and species richness of the Galapagos unique.

3.4 Conclusion

During this paper, the following research question was looked into: How does the development of islands, due to plate tectonics, glaciation processes and social actors, influence the development of ecosystems and their species on the Galapagos Islands? To answer this question an analysis of the past, present and future of the archipelago was made.

Islands act as natural laboratories for research to evolutionary mechanisms. The influence of area, age, distance to mainland and amount of resources available are all actors that result in the way ecosystems can be found today. Islands, such as the Galapagos, are isolated habitats, that result in high levels of endemism. Also, the glaciation processes that occurred in the past have influenced these actors in such a way that it partly determines the consistence of ecosystems today.

It is from vital importance that this natural laboratory maintains the way it was before man arrived on the archipelago. In this way the evolutionary processes that occur on the Galapagos Islands can be examined and eventually used as a models for the entire planet.

The challenge for the future is maintaining this rich and unique biodiversity, that knows many endemic species, and reduce the impact of population and tourism growth, and the introduction of alien species. Today, the focus is mainly put on economic growth of the ecotourism sector of the Galapagos, while this is a non-sustainable way to enter the future. The preservation of the ecosystems in National Parks should be reinforced by not using parts for the greater economic good. Otherwise, the pressure on the resilience of the ecosystem of the Galapagos Islands may become too big, which results in a collapse and the disappearance of many endemic species.

Concluded, the actors that are described in this paper all influence the development of ecosystems and their species on the Galapagos Islands, some more than others.

4. Chapter discussion

In this chapter three papers about the Galapagos Islands have been discussed. All three with their own subject of inquiry, but all with their own perspectives on the islands. In this part of the book chapter the overarching theme will be discussed; change.

Islands can be seen as natural laboratories, which are undergoing a constant change. Change can be good, but this has not always been the case on the Galapagos Islands, as shown in this paper. Starting with the influence of the tourism industry, which has been growing at a high rate since the 1960s. The new economy resulted in a shift of income from fishery and agriculture to the tourist sector. This change has brought a lot of well fare and improvement of the quality of life. Infrastructure, education and healthcare were part of the growing well fare. However, this change also knows a negative side, which has appeared on many islands that have a big tourism industry. With more and more tourists arriving on the Galapagos Islands each year the resilience of the ecosystems was pressured.

Since the islands of the Galapagos are home to many endemic species, the consequences are clearly visible. These ecosystems are changing and many of these species have become endangered. By looking at the consequences the conclusion can be drawn that this development was not sustainable. Since the exact response of the local ecosystems is not completely understood, it would be interesting to look at the interaction of the ecosystem and the inhabitants of the Galapagos Islands. Consequently, there can be looked into how other islands which are undergoing such a growth can do this as sustainable as possible. Tourist and nature conservation management should go hand in hand to reach this goal.

What is of great importance to reach this goal is the education of residents. In this way they recognize and acknowledge the importance of functioning ecosystems. They are part of the system as they use multiple ecosystem services and have direct impact on it. If the residents have the knowledge about their interaction with the ecosystem they can work on conservation strategies properly and protect the special and interesting species that can only be found on the Galapagos Islands.

In order to create a framework that is suitable for multiple islands it is important to gather different disciplines. In that way multiple perspectives are used and no element is left out. This is also applied in this paper. By looking from a social-economical perspective the interests and principles of the residents were shown, who want to benefit both from the tourist sector and the ecosystems of the Galapagos Islands. Secondly, by looking from a bio-physical perspective at the sustainability of the giant tortoise the behavior of endemic species was shown. In order to preserve the rich biodiversity of the Galapagos Islands it is important to understand the changes that this tortoise species had to cope with, as this could also be applied to other species. Thirdly, by looking at a bio-physical perspective again, but now at the principles that lead to the specific development of ecosystem, the processes are shown. These are important to understand how the ecosystem has reached its current state.

The combination of multiple disciplines has provided the start of a framework about the Galapagos that has potential to grow into a framework that could be applied to the world. The Galapagos Islands could become a simplified model for ecosystems all over the world. What is missing in this analysis is the inclusion of different disciplines, such as cultural studies. This could be an idea for further research.

5. Chapter conclusion

In this chapter three different analyses of different topics are presented. As we have seen the common issue of these three papers is change on the Galapagos archipelago. The first analysis was about the changes and effects of the tourism on the Galapagos archipelago in the last century in a social economic perspective. The second topic was about the sustainability of the giant tortoises on the Galapagos archipelago. And the last analysis of this chapter was about the development of the biodiversity due to plate tectonics and glaciation processes.

In the first analysis the main question was 'what are the most important changes that took place on the Galapagos islands because of the tourism industry, focused on social- and economic aspects? This question was divided in three different sub-questions: the first sub-question was 'what has been the impact of tourism on population growth?'. The second sub-question was 'what has been the impact of tourism on the employment?' and the third sub-question was 'what has been the impact of tourism on the prosperity?'. The conclusions of this analysis are that the most important daily work changed the focus from fish and agriculture to tourism industry due to a big increase in tourism. This led to more money for developments of the island and these developments and work opportunities led to more immigration from the mainland. The downside of this growth is more pollution and disturbance of the ecosystems.

In the second analysis the main question was whether the population of giant tortoises on the Galapagos archipelago is sustainable or not. The conclusions of this analysis are that without humans, only one of the eleven tortoise-species is probably sustainable, based on an estimated viable population of 4000-7500 individuals. It is important that measures will be taken to make sure that the other populations could survive in future.

The final analysis of this chapter has as main question how the development of islands, due to plate tectonics and processes of glaciation, has influenced the development of ecosystems and their species on the Galapagos Islands. The conclusion of this paper is that there are many factors that influence the biodiversity like the area, age and resources of the islands, the distance to the mainland and the glaciation periods. However, the biodiversity of the Galapagos is heavily challenged by the growing population, increasing tourism and the introduction of alien species. The general conclusion of this chapter is that the archipelago is very dynamic and because of big changes like tourism growth and the changes in the ecosystems, the resilience of the Galapagos is under pressure, causing non-sustainable ecosystem development.

The lessons that can be learned from this chapter for other islands or isolated places and even continents are that tourism can have a great impact on the society and on the ecosystems. To make sure the negative impacts are as low as possible and to make sure that the island is more sustainable in the future, it is necessary to be prepared to the changes and make plans how to manage this. Also important lessons about the biodiversity can be learned from this chapter. For example, what factors are important for biodiversity and how these could be preserved. Therefore, the Galapagos archipelago could be used as a model for many other places.

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Other

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- Council on Hemispheric Affairs
- WWF

Bonaire in Transition

Analysing the sustainable transitions in Bonaire's tourist economy and energy system

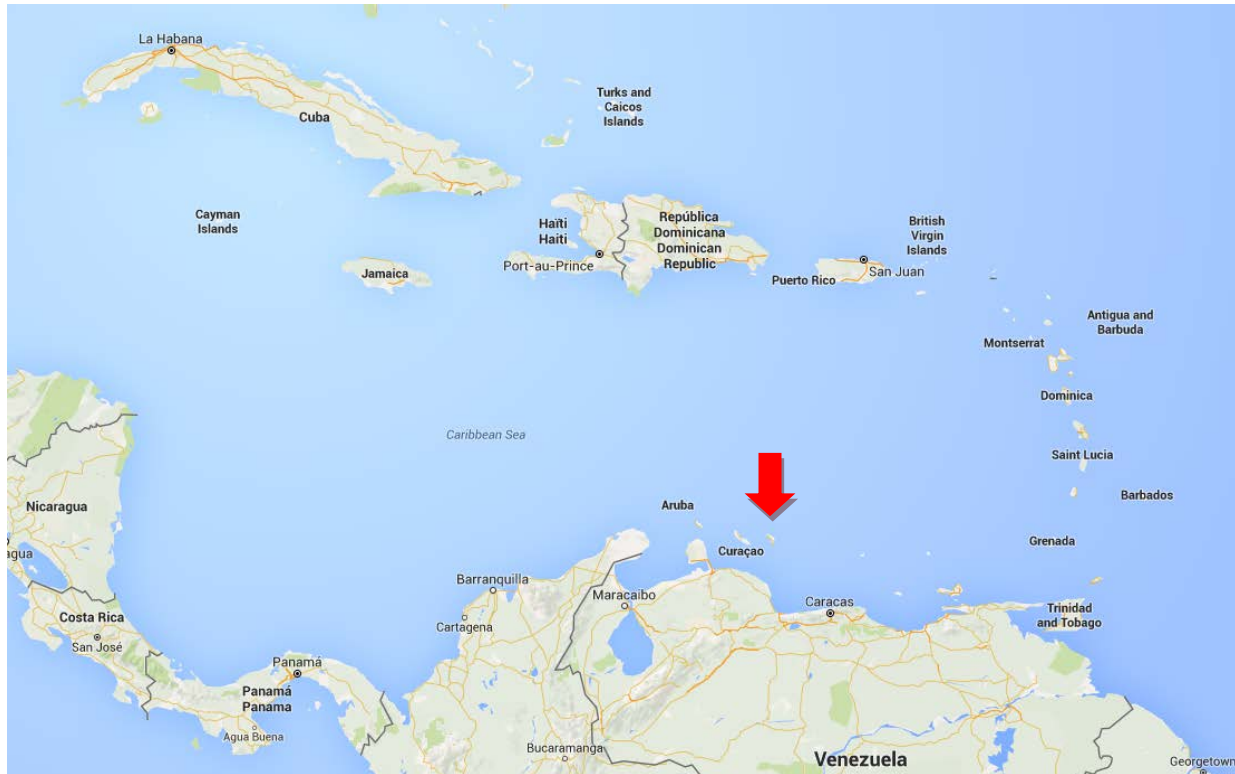


Figure 1. Location of Bonaire (Google Maps, 2015).

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Course: Islands: Models for our Planet – Metaphors for our World

Island: Bonaire

Topics: Energy & Economy

Date: 29-01-2016

Abstract

Bonaire in Transition presents two ways in which Bonaire is developing sustainable strategies on the island and tries to become more self-sufficient. The transition towards a fully renewable and self-sufficient energy system is being facilitated by gradually replacing the fossil fuel share in the generation mix with locally produced algae-oil. Combined with the already present wind turbines, this Hybrid Renewable Power Plant will therefore produce its 25MW purely on local renewable energy sources in the future. Another transformation is seen in the economic sector of Bonaire. The island is becoming increasingly dependent on tourism, and therefore has to develop sustainable strategies to prevent tourism from harming the local environment. There is however enough awareness on the island to guide the increasing tourism trend. The Wolfs Company research center and the possibility of a 'Blue economy' from Gunter Pauli contribute to raise awareness of possibilities and develop innovative sustainable strategies. There are therefore many possibilities to learn from the transitions on the energy and economic department on Bonaire.

Chapter introduction

In the Caribbean Sea, above the North Western coast of Venezuela, you will find the ABC islands of the Lesser Antilles. The most eastern island, as showed in figure 1, is called Bonaire. Bonaire is a typical tropical island surrounded by water (Wong et al., 2005). This rather small island is officially a special municipality of the Netherlands. It is an overseas municipality with a special status. This means that there is a local government, which operates under the Dutch law but with a high responsibility of implementation (Landenportal, n.d.). Insularity as a typical feature of an island is not typical for Bonaire because of the strong political link with Holland. This makes the island less insular than other self-governed island states (Wong et al, 2005). Yet, the island is not comparable to the Netherlands at all. Bonaire and the European country differ in social, cultural, economical and natural ways. The weather of Bonaire is tropical and the inhabitants are less hurried than the Dutch. The island is therefore a popular tropical retreat for tourists, but the island is also known as an idealistic place for retired Dutch people, escaping the cold weather and the hectic life at home (Bennekom, 2012). For some, the most attractive feature of the island is the pristine coral reef along the entire coast. Scuba divers and snorkelers love it. To protect this nearby coastal reef it is designated as a marine sanctuary. It is called the Bonaire National Marine Park and contains coral reefs, mangroves and beautiful tropical fishes (TEEB, 2012).

Bonaire is having a high reliance on imports, limited resources and high dependency on tourism. There are however many incentives to increase the self-sustainability of the island. Bonaire can therefore be taken as a model for other islands on making sustainable transitions. This book chapter will explain two ways in which Bonaire aims to transition to become a more sustainable and self-sufficient island. First, the transition to a fully renewable energy system is described. Second, the sustainable transformation towards a tourist-driven economy is discussed. These topics are especially relevant to study on Bonaire as a lot of important lessons can be learned by other islands. Bonaire can maybe even serve as a role model for the rest of the world.

Bonaire's transition to a renewable energy system

Analysing the current and future state of Bonaire's energy supply

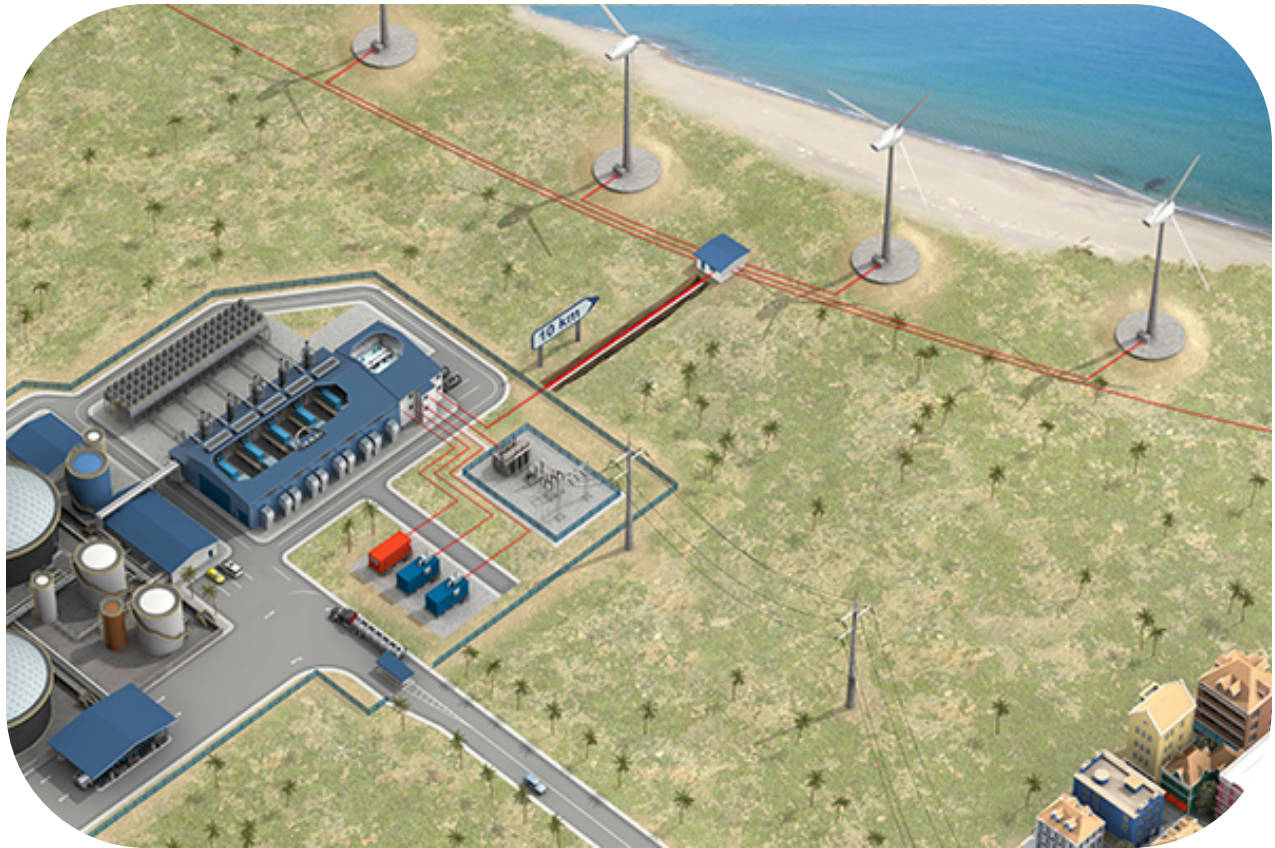


Figure 2. Example of a Hybrid Renewable Power Plant (Man Power Plant, 2015)

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Course: Islands: Models for our Planet – Metaphors for our World

Island: Bonaire

Topic: Energy

Word count: 2987

Introduction

With complex global issues such as climate change, fossil fuel depletion and sea level rise having a large impact on the liveability of Small Island Developing States (SIDS), a lot of effort has been made on many islands to improve on sustainability and self-sufficiency (Norder & Rijdsdijk, 2015a, 2015b, 2015c & 2015e). In this way the islands aim to become less dependent on imports of for example food, water and fossil fuels for energy consumption. The urgency and possibility of increasing sustainability and self-sufficiency is often largely connected to the level of isolation, economic welfare and governance on the island (Norder & Rijdsdijk, 2015a, 2015b, 2015d & 2015e). With the recent goal of the World Climate Summit in Paris for a maximum of 1.5 °C increase of global temperature, it is important to learn from the initiatives taken by SIDS to accomplish this goal. This is because an island can often be seen as a model for the rest of the world (Norder & Rijdsdijk, 2015a, 2015b & 2015e). Islands are often also the most vulnerable to the global changes. This forces island communities to take the first step in finding suitable solutions. Since fossil fuel reserves are being depleted at an alarming rate, it is necessary to develop and transition to renewable energy systems in the near future. Many islands have already taken large steps in transforming their way of energy supply.

This paper will analyse the way in which Bonaire aims to achieve a transition to such a renewable energy system. Bonaire has already outspoken its plans to become completely energy self-sufficient for its 14,500 inhabitants and 70,000 annual tourists (Bognar, 2013; IIIIEE, 2010). It is therefore interesting to follow this transition very closely. This paper therefore aims to answer the following question: *How is the transition to a fully renewable energy system being facilitated on Bonaire?* To be able to answer this research question and gain useful information the following sub-questions are used:

-What does the current energy system on Bonaire look like?

-How is Bonaire going to transition to a fully renewable energy supply?

-What can be learned from Bonaire's transition to a fully sustainable energy system?

This analysis could be used for the transition to renewable energy systems on other SIDS and maybe even play a model role for the rest of the world.

This paper will start by analysing the current situation of the energy system on Bonaire. The way in which Bonaire aims to transition to a fully renewable energy system and become completely self-sufficient energy wise is discussed next. Lastly, a view on the lessons to be learned from this transition is proposed.

Bonaire's energy supply

When trying to integrate sustainability it is important to guide an implication through the object, network and system indicators of the dynamic system present on the island. As energy is one of the bottom object indicators that has influence on all other object indicators in a dynamic system (figure 3), it is often seen as the building stone of improvement. This might be a reason why many isolated communities such as islands have focussed on making their energy supply more sustainable. Examples of such activity are depicted by the Carbon War Room, aiming to make the energy supply of the Canary Islands more renewable, and sustainable energy projects on the islands of the Dutch Antilles (Norder & Rijdsdijk, 2015b). Bonaire's energy project is therefore an ideal case study to learn about facilitating a transition towards a renewable energy system.

This section will start by looking into the energy system that is currently being used on Bonaire. The aim of a transition to a fully renewable energy system described next. Throughout these parts there will be a focus on the sustainability of the system and the lessons to be learned from this transition.

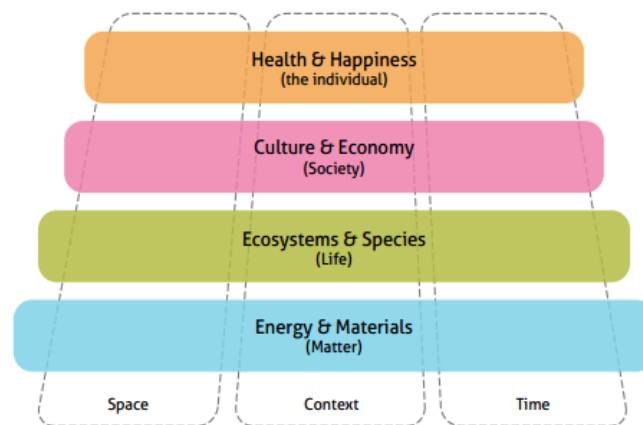


Figure 3. Energy as bottom object indicator (Norder & Rijdsdijk, 2015b)

Current energy system

Bonaire currently has a Hybrid Renewable Energy System (HRES, Figure 2) with 25 megawatts (MW) capacity, run by Ecopower Bonaire BV (Neves, Silva & Connors, 2014; IIIIEE, 2010). The system is a combination of a Diesel Power Plant (DDP) with wind- and solar energy. It currently has a combined energy use potential from Renewable Source (RES) of around 40-45% (Neves, Silva & Connors, 2014). There are however plans to further increase the RES. The division of the energy generation mix is shown figure 4.

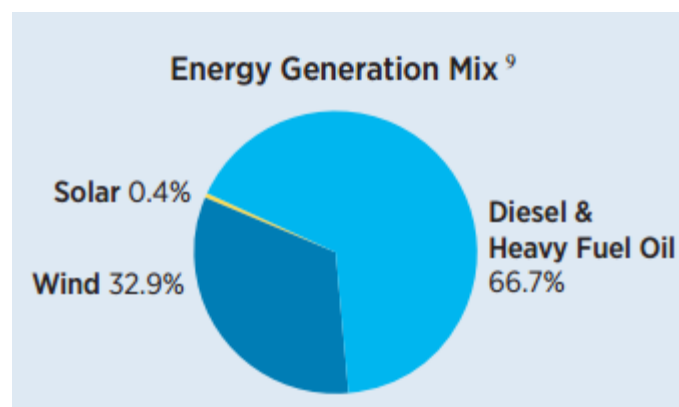


Figure 4. Energy Generation Mix of Bonaire (NREL, 2015)

Bonaire's energy supply system is currently the largest wind-diesel- installation on the world and was completed in 2009 after a fire destroyed large parts of the previous DDP in 2004. Before this fire, Bonaire was almost entirely dependent on fossil fuels for its energy generation, making the inhabitants vulnerable to fluctuating oil prices. The system is a combination of twelve wind-turbines and five diesel generators, being able to handle the peak load of around 11MW (Bognar, 2013; NREL, 2015). The total capacity of the twelve Enercon wind turbines is around 11MW, while the five MAN diesel generators thus combine for a total of 14MW. This system is of course very wind dependent since the wind turbines take a large share of the energy generation mix. The diesel generator is therefore made to be relatively flexible to adjust to the variable generation output of the wind turbines, which can be around 90% during peak wind-energy generation. To ensure the stability of this energy grid, a back-up battery supply storage with a 3MW capacity was installed. An additional back-up diesel generation system with a 3MW capacity was also installed to secure the system stability even further. The graphic representation of the system is shown in figure 5.

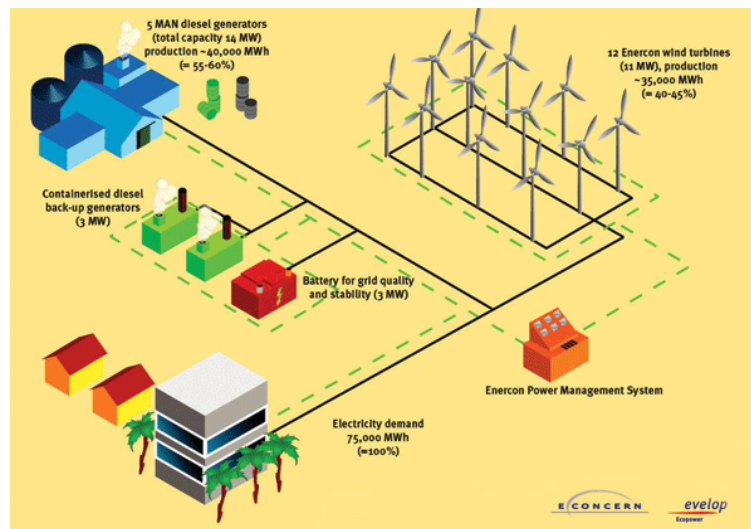


Figure 5. Representation of Bonaire's energy grid (PII, 2015)

The last part of the energy supply system is solar energy. While having a high potential value, this share is not very significant as only residential energy production contributes to the energy mix. Bonaire has simply chosen to focus on a combination of wind- and diesel energy for a constant and sustainable energy supply. While the diesel power plant is currently being driven by fossil fuels, the aim is to replace this entire share by renewable energy sources (Bognar, 2013).

Future aim

Although the fire in 2004 was a tragic event and an economical setback, this accident gave Bonaire the opportunity to start from scratch and focus on building a sustainable energy system. The goal was therefore set to become the first island to become CO₂ neutral. A large part of this plan is the transition to the fully self-sufficient renewable energy system by combining wind- and bio-fuel energy (IIIEE, 2010). The energy share of the DPP that is still provided by fossil fuels is being replaced in the future with bio-fuel. The DPP was namely built to be extremely flexible; being able to operate on both crude- and bio-diesel and being able to adjust to the power generating share of the wind turbines. The transition to the use of bio-fuels is facilitated by gradually switching from imported vegetable-oil to locally produced algae-oil, making the energy system 100% renewable and self-sufficient (Bognar, 2013). It is expected

that the option to switch to bio-fuels will continue to become more attractive as crude oil prices are expected to increase in the future. In this way Bonaire tries to reduce the price of the still relatively costly energy (around \$0.35 per kWh) due to oil imports (IIIEE, 2010).

Apart from the implemented wind-diesel-installation there has been a general interest in building centralized solar parks for additional renewable energy generation (IIIEE, 2010). These solar parks have a high potential of application on Bonaire as the island enjoys many sun hours annually. Local efforts to increase residential implementation of solar panels are therefore also attractive. The combination of these centralized solar parks with increased residential solar energy production might make a significant contribution to the energy mix. The addition of solar energy to the energy generation mix will increase the resilience of the energy system even further. This will make the system less vulnerable to an unexpected setback such as the 2004 fire.

Other forms of renewable energy were also investigated; figure 6 shows the potential of each renewable energy source and the installed capacity on Bonaire. The use of Geothermal and Ocean energy might also be interesting to look at, since the potential of these sources is still unknown. The expectation is however that only wave and/or tidal energy could be an additional source of energy. Although this would be interesting to investigate, case studies on Ocean energy on other islands could be used for additional application plans. Future expectations for Marine sustainable energy sources (tidal/wave/ocean) are however very low, as it is very difficult to build suitable high capacity systems (Panwar et al. 2011), but small scale applications might still become a future option. Right now the focus remains on the combination of Biomass and Wind energy on Bonaire as large investments have already been made and a suitable infrastructure for utilizing these sources is already present.

Renewable Energy Status and Potential^{9,14}

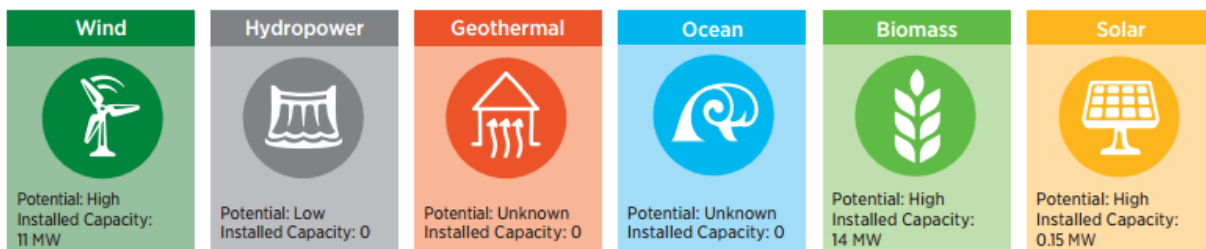


Figure 6. Renewable Energy Status and Potential of Bonaire (NREL, 2015)

As described above, the energy system needs to make a transition from fossil fuels to bio-fuel in its DPP to become completely renewable. This is done by replacing the crude oil fraction first with vegetable oil, and later with locally produced algae oil. Also the storage facilities for peak production from the wind turbines should be improved for higher efficiency. Improvements on both areas are expected to take a lot of time, but both options will in the long term make the island completely self-sufficient energy wise. The most challenging part of this transition is the switch of fossil fuel usage to locally produced algae oil. Ebbing (2012) investigated the possibility of bio-fuel production from micro-algae on Bonaire and states that Bonaire is a 'near ideal' location. This is because of the high solar irradiation throughout the year in combination with the shallow ponds near the sea (Norsker et al., 2011). This makes Bonaire a highly advantageous location to experiment with algae production compared to algae production in The Netherlands. It was estimated that algae production and experimentation would be around 50% more efficient on Bonaire compared to Holland (Ebbing, 2012). The technique is however not commercially feasible in The Netherlands, and a lot of improvements need to be made before it is a realistic

replacement as bio-fuel for the DPP of Bonaire. A full transition to the locally produced algae-oil is expected to take another few decades as more research and experiments are needed for improved results. The pros and cons of algae production on Bonaire are listed in table 1:

Pros	Cons
Very high average irradiation per day (Norsker et al., 2010)	Little space for building
Easy access to salt water	Little available nutrients for production
Low costs in terms of salary (Bonisha., 2007)	Building & operating knowledge not available yet
Biofuel prices are competing better to the ever increasing local prices of crude oil	Importing costs for prefabricated parts
Bonaire is still part of the Dutch Kingdom	Corruption (Bonisha., 2007)
	High environmental standards

Table 1: Pros and Cons of algae production on Bonaire (Ebbing, 2012)

The transition towards a fully renewable energy based system is clearly in full process on Bonaire. As Bonaire aims to become the first CO₂ neutral island, there are still some areas to improve on. It is therefore important to look at the areas of improvement and see what lessons can be learned from the way that Bonaire is facilitating the transition to a renewable energy system.

Lessons to be learned

Bonaire is in a very unique situation to improve its energy supply system. The fire in 2004 has enabled Bonaire to transition towards a fully renewable energy system. But this is of course not the only factor that contributes to the potential of revamping the energy system on Bonaire. As Bonaire is a Subnational Island Jurisdiction (SNIJ) as municipality within the Kingdom of The Netherlands, it has financial advantages that make this transition possible (Baldacchino, 2006).

The location of Bonaire also contributes to high irradiation values that raise the potential of growing algae for bio-fuel production (Norsker et al., 2011). This in combination with plenty of nearby salt water, low salary costs and increasing prices of crude oil makes Bonaire an especially suitable location for local algae-oil production. It is therefore important to not simply copy the strategy used on Bonaire for locations that do not share the same characteristics. Transitioning to a renewable energy system should therefore only be started when a location specific analysis of potential renewable energy sources has been conducted.

Islands that share the same characteristics can however learn from the transition that Bonaire is experiencing. The other large islands of the Dutch Antilles, Aruba and Curaçao, can for example exchange information and experiences to simultaneously aim for a renewable energy system. On Aruba and Curaçao there are namely also initiatives to make a transition; on both islands around 20% of the energy share is produced by wind parks (Shirley & Kammen, 2013). Other islands in the Caribbean or islands near the equator that share the high irradiation values can also research and experiment with production of locally produced algae for bio-fuel. This could be profitable as they have locations favorable for the production of algae biomass compared to the mainland. The power plants on these islands should however be able to process this type of fuel and in many cases investments for a new system are therefore needed. This may however not be attractive as investments in the current energy system might not be earned back yet.

Another factor that holds back the transition to a renewable energy system is the lack of suitable ways to store energy. Renewable energy systems are often defined by instable amounts of energy production. Wind turbines and solar panels are of course dependent on wind speeds and solar irradiation levels. It is therefore important that for high efficient renewable energy systems that there is a suitable energy storage facility. This facility should be able to store energy at peak production and supply energy at low energy generation in a flexible way. Currently, the lead battery-storage systems are often very expensive, use a lot of rare metals, take a lot of space and have insufficient lifetimes to be suitable for a renewable energy system grid. There is however a lot of research into alternative energy storage systems such as: Pumped hydro storage (PHS), Thermal energy storage (TES), Compressed air storage (CAES), Flow batteries and Fuel cells. Most of these systems are however very dependent on local features and/or are still not economically feasible (Ibrahim et al., 2008). Continued research into suitable energy storage systems that can assist a decentralized energy grid is therefore highly needed.

The transition to a renewable energy system with 100% self-sufficiency is of course a big step in sustainability of a certain area. As energy plays the role of the bottom object indicator in a dynamic system, it will have influence through all other object indicators in the system (Norder & Rijdsdijk, 2015b). The transition to the renewable energy system for example also supplies the high energy consuming desalination plant for local drinking water production with energy. The higher level of self-sufficiency of course influences the local economy by reducing the dependency on imports and becoming more resilient. This will lower prices and raise living conditions and possibly influence the level of happiness on the island.

When looking at Bonaire as a model for the rest of the world, it is obvious that the level of self-sufficiency still needs a lot of work, even on one of its most advanced areas. Bonaire does however make effort to show a solution that can be incorporated by other locations with similar characteristics. The transition on Bonaire to a renewable energy system should therefore be continued to be monitored. Bonaire can also serve as a model of showing the planetary boundaries by aiming for self-sufficiency.

Conclusion

There is a transition from a fossil fuel dominated energy system to an energy system that completely runs on renewable energy sources on Bonaire. The current Hybrid Renewable Energy System on Bonaire was completed in 2009 after a fire had destroyed its previous diesel generator. This made it possible for Bonaire to build an energy system that aimed for the use of 100% locally produced renewable energy resources. In this way Bonaire will be completely self-sufficient energy wise and serve as a model for other islands and possibly even for the rest of the world.

Currently, the wind turbines generate up to 40% of the annual energy mix. The other 60% is generated by the diesel power plant (DPP) that currently still runs on fossil fuels. Solar energy plays an insignificant role in the energy mix. As energy is the bottom object indicator it influences all other object indicators above it in a dynamic system. Aiming for a renewable energy system is therefore a logical first step in raising sustainability levels.

Bonaire aims to replace the share of the fossil fuels in the DPP with bio-fuel first with imported vegetable-oil and later with locally produced algae-oil. Bonaire is a location with high potential for producing algae-biomass, but the technique of algae-oil production will still need a lot of time to develop into an economically feasible solution. There are also plans to improve the energy storage systems on the island to make more efficient use of the wind turbines. Alternative renewable energy production can be found in solar- and ocean energy through centralised solar parks and tidal wave energy. The total mix of renewable energy resources will then be able to provide the energy needs for all inhabitants of Bonaire.

The information on the transition of Bonaire to a fully renewable energy system can be taken as a model for other islands that share the same characteristics. For other locations it could provide useful information, but a location specific analysis should be conducted before implementing solutions. This transition can however serve as a model to reach for self-sufficiency. As the Earth still the only habitable planet, the boundaries and resource limitations become increasingly clear on a global scale. Bonaire might give useful insight into possible solutions when the transition is successfully made.

Transforming into a sustainable tourist-driven economy

Name of Island: Bonaire, a special municipality of the Netherlands situated in the Caribbean Sea

Topic: Economy

Author: Moon van Koolwijk (moonvank@gmail.com, 10440380)

Amount of words: 2900

Introduction

Bonaire is a popular tropical retreat for tourists, but also an idealistic place for retired Dutch people, escaping the cold weather and the hectic life at home (Bennekom, 2012). For some people, the most attractive feature of the island is the pristine coral reef along the entire coast. Therefore, it is a pleasant holiday destination for scuba divers, snorkelers and surfers. So mainly the natural features attract people to visit the island, which makes it inherent to the tourism based economy. Therefore, the islands ecosystem is beneficial to the economy of Bonaire. As an result of the interplay, the coastal reef is designated as a marine sanctuary in order to preserve the islands nature and protect it from human destruction. It is named the Bonaire National Marine Park and contains coral reefs, mangroves and variegated tropical fishes, but also a 55 square kilometre park (TEEB, 2012). Meanwhile, Bonaire is an island with just a few sufficient resources, therefore it relies high on import and revenues from the touristic sector.

If tourists are so thrilled by the islands natural appearance, it is not strange at all to see a major connection between a healthy ecosystem and overall incomes through tourism. To be more specific, much of Bonaire's economy and many of the residents (working in the tourism sector) trust on the quality of the ecosystem of the island (TEEB, 2011). In that case maintenance of the ecosystem is necessary to continue holiday visits and therefore economic growth on the island. So, the linkage between a healthy ecosystem and economic growth through tourism is an important case, but in which extend do islanders themselves and the local government see this importance? Are there people present with some kind of authority that are able to shift the island into a naturally more sustainable system and therefore a stable economy? For this inquiry the following questions are formulated in order to find answers throughout the paper:

- *Is there enough awareness about environmental sustainable development with islanders and decision makers?*
- *Is Bonaire transforming into a more sustainable, touristic-driven economy thanks to this awareness?*

Bonaire has limited resources and is extra fragile to external effects. The economy is not complex, what makes it highly vulnerable but also manageable (Norder & Rijdsdijk, 2015c). The island depends on limited diversification in export production and relies highly on import from abroad (Wong et al, 2005). While keeping this in mind, economic development will make Bonaire a better place to visit and to live, but in a sustainable way. Inhabitants can contribute to this better livelihood if they know how to be social and especially environmental sustainable. Because Bonaire and its community are vulnerable to rapid external changes and so it is highly recommended to strengthen their local natural qualities. For

Bonaire this means to manage sustainable tourism as a booster for the economy. If the economy is strong, the islanders will depend less on other countries which makes them resilient (Norder & Rijsdijk, 2015b). Secondly, a sustainable economy is beneficial for the independency and autonomy of Bonaire as a self-governed small island state.

At the same time Bonaire is a physical small island with clear boundaries and quite a one-sided economy, thereby it is easy to examine how sustainability can integrate into the life of islanders and therefore can stimulate economic growth (Norder & Rijsdijk, 2015b). In this way it can be a pilot project for the future of other similar islands and countries with matching features.

The first section of this paper gives an overview on the current economic and environmental situation of the island. The second part gives an overview about how the economy of Bonaire is on its way to be more resilient and more sustainable, for futures sake. The information for this paper is gathered from the results of an in-depth literature study. In the conclusion, the findings of the analysis will be summed up and the central question will be answered.

The current situation

So, obviously there is a strong linkage between sustainable economy and tourism on the one hand and the ecosystem on the other hand. This section draws the current situation of Bonaire. It describes in what way tourism drives the economy and how the nature contributes to this tourist based economy.

Economy and tourism

Tourism dominates directly and indirectly the economy of Bonaire, but it is not the only sector contributing. Figure 7 shows the contribution of all kind of different sectors to Bonaire its GDP in 2008. The largest employer of the island is the public service (Groenenboom, 2009). What strikes in this pie chart is that agriculture has just a small share. It is because agriculture has never matured on the island. What strikes secondly is the lack of large industries. The reason is because there is no such place for large industries on the relatively small island. In opposite to this, the strong bond between inhabitants and the sea is nevertheless a profitable outcome for Bonaire. Fishery is still a daily routine for people. Although, the fishermen do not use high tech instruments, they sell their fish well locally. In this way fishing is a provisioning service (Wong et al., 2012). The oldest surviving industry is the salt production. This is possible because of the Southern salt pans, which covers 10 percent of the island surface. The salt is mined from the sea pans and produced for commercially use (Groenenboom, 2009).

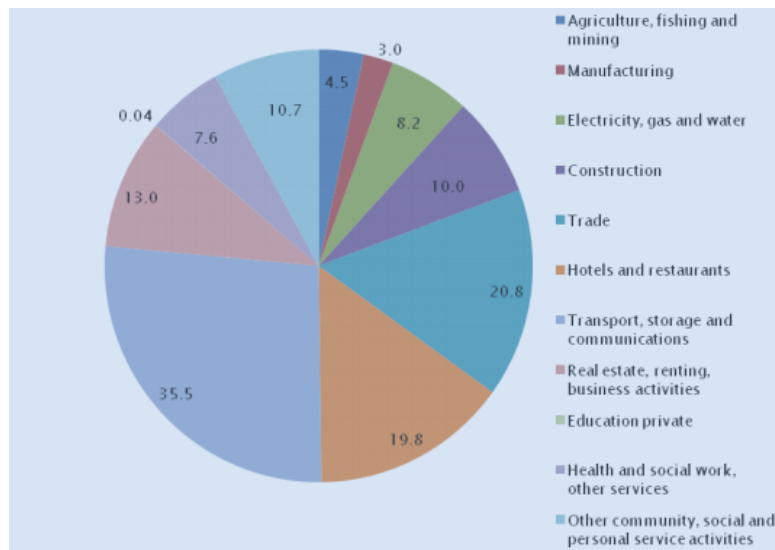


Figure 7. Different sectors of Bonaire (Lely et al., 2013).

The principal economic pillar is tourism and this still increases every year. This is, among other shares, shown in the second largest share that contains hotels and restaurants but also in the continuing construction industry share of 10 percent. According to figure 8 the number of stay-over tourists are quite stable, but the number of cruise tourists has been growing since 2005 and still is growing every year (Schep et al., 2013). Due to high touristic visits, the construction sector is flourishing, because there is an increasing demand for houses and other sorts of accommodation (Lely et al., 2013). In 2012 the direct contribution of tourism of the island economy has been calculated. The research results explained that 16,4 percent of the total economy flows from tourism. Tourists spend their money mainly on hotels, restaurants and bars. Besides that, other services are linked to tourism like transport, cultural services and recreation. The latter one can be seen in light of the large variation of active sports that can be practised, like scuba diving, snorkelling, wind surfing and kite surfing (CBS, 2015). The healthy coral reef ecosystem is highly important because of the tourists who visit for the island for scuba diving and snorkelling. A sustainable use of this natural asset is therefore in the islands interest (Lacle et al, 2012).

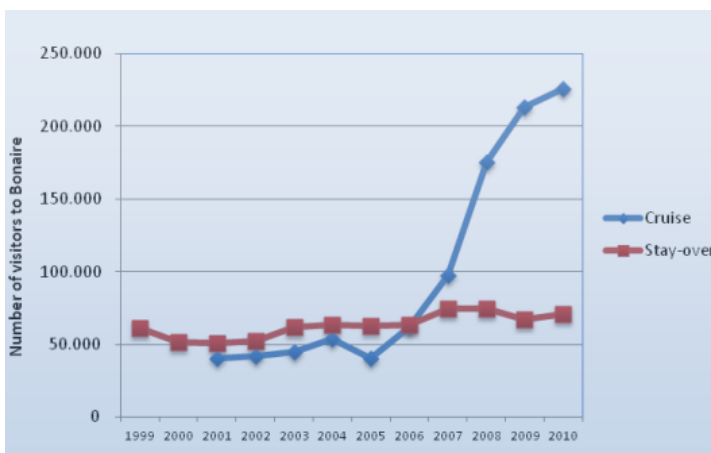


Figure 8. Stay-over and cruise tourists per year. (Schep et al., 2013).



Figure 9. A scuba diver exploring the underwater nature of Bonaire. (TEEB, 2012).

Nature and ecosystem services

As seen historically, Bonaire’s inhabitants lived in balance with the unique environment and biodiversity of their island. The coastal waters contain coral reefs and tropical fishes, mangroves and sea grass. However, modern affairs affect the ecosystem and its services. Pressures like economic development have led to environmental degradation (TEEB, 2011). The increasing number of tourists put extra pressure on the ecosystems because of the attraction of its services. The reefs attract divers and snorkelers (see figure 9), the mangrove forests attracts kayakers and other boaters, then the beaches lend themselves as perfect relaxing places for another variety of tourists. The quality of once a healthy system has declined in the last couple of years as a result of the touristic activities (TEEB, 2012). Saying this, the ecosystem services, explained as the benefits that nature supplies to human society, are abused. Those services on Bonaire are seen as (semi-)public goods and are highly vulnerable to overuse and degradation.

The economic growth through tourism is great for Bonaire its economic income, but it must archived in a sustainable way to preserve the healthy ecosystem and its services. The ecosystem services are what attracts the tourists after all! It is also clear, on the other hand, that the wealth of an islands ecosystem has significant implications for social and economic wellbeing of an island like Bonaire (Wong et al., 2005).

Awareness for the future situation

A lot has been written about the future economy of Bonaire based on a, as healthy as possible, environment with tourism as largest driven sector. This section is about how Bonaire economically can grow but at the same time retain the islands healthy ecosystem and its services.

The ecosystem and economy in harmony

A self-contained island is not sustainable, therefore the island needs people that are aware about the degree of sustainability, but they also need a sort of authority to change the common course of events. It is because of this, that certain stakeholders are important for change. Especially if those people have a large say in decision-making, realise that sustainable development is the only essential way for economic growth and are very active in preserving the limited natural resources (Norder & Rijdsijk, 2015b). A very important stakeholder, as regarding to the ecosystem of Bonaire, is a research company on the island that is called Wolfs Company. They support the public and private sector on maximizing the economic and social fruitfulness of a healthy ecosystem. It is strongly linked with the local government, which makes them very influential on this very small island. They start all kind of collaborations with entrepreneurs in different sectors of the economy, in order to learn them to be more sustainable in the future. The deriving projects from these collaborations to help Bonaire to be a more sustainable economy, or a *green* economy as Wolfs Company name the conscious transformation of the economy (Wolfs Company, n.d.). *Green* growth means an increasing economic development without being harmful to the climate, water, soil, elements and biodiversity. This sustainable movement cares about a good world for future generations but also wants to generate economical welfare and strengthening the competitive position (Sligerland et al., 2014). Wolfs Company is trying to trickle down the *green* concept through the society of Bonaire. They found an economical way to value the ecosystem, which they aim to create policy instruments for sustainable development (Wolfs Company, n.d.). In this way they emphasise on the economic benefits of biodiversity but they also show the losses and degradation of the ecosystem. Meanwhile they tend to find out what the willingness of individuals is to literally pay for maintaining a healthy environment. Because of this economical estimation they are also able to make scenarios, which could be used by decision makers by choosing the right strategy in future planning (TEEB, 2011). They do not focus on revitalizing the environment but they try to find ways to prevent the ecosystem of further damaging (TEEB, 2011). Via a public survey they monitored the awareness of the economic value of nature. Besides that, they also focused on the tourism value because of the assumption that tourist have the largest impact on the degradation of the islands ecosystem. Therefore, they also conducted a survey on tourists to see what they would pay in light of the protection of Bonaire its nature. As a result of these surveys it turned out that most of the tourists and, although in lower amount, inhabitants were willing to pay for a healthy ecosystem in the future (TEEB, 2011).

Wolfs Company has shown that nature can be expressed and valued in an economical way. This makes it easier to deal with possible future problems in relationship to the environment. They are able to show decision makers the willingness and support of inhabitants as well as tourists for policy about sustainable development. To make it clear in numbers they made a calculation to show how important

the ecosystem from Bonaire is for the overall income. The GDP of Bonaire (in 2008) was about 224 million dollars. The total economic value to grasp the role of nature in the economy of Bonaire was estimated at more than 105 million dollars. This means that half of the economy of Bonaire derived from the ecosystem in the year 2008 (TEEB, 2011).

From a green economy and blue economy

Following this *green* way of thinking, Bonaire is already introduced to the relatively new concept of the *blue* economy. A man called Gunter Pauli, brought a visit to the island and researched the possibilities for a *blue* economy on Bonaire. The fundamental idea, likewise *green* economy, is to make the connection between economy and ecology. But the concept fits more to the idea of strengthen the local existing qualities. Pauli claims that the *green* way is good, but expensive and only cut costs for the islands future. He sees the *blue* way as more innovative and therefore better. He emphasises that in a *blue* economy more jobs can be generated and the most important, it generates more value with what is present (Pauli, 2014). Waste in this case is useful and by-products can be seen as the source of new products (Bogdana et al., 2014). This *blue* economy will contribute to increasing profits and lower the costs, and the society of Bonaire will be more sustainable as ever. Moreover the focus will not be on tourism only, yet the idea broadens the economical horizon of Bonaire. The concept is self-sufficient and the focus will be on aspects like the environment, energy, innovation agriculture, telecommunication and transport (Bonaire Vandaag, 2014). This concept distinguish itself from early on *green* economy in its way that it not only will strengthen its resources but also will diverse the economy of Bonaire.

The local government of Bonaire is adopting the principles of the *blue* economy by stimulating sustainable and innovative projects and by organising *blue table days*. With the latter concept they invite representatives of the public, public-private and private organisations so they can exchange ideas and pitch their potential *blue* project. It seems to be a very valuable concept, because several layers of society (people of the government, of enterprises, of nature organizations, from an educational angle, of science and residents) meet each other by the connection they share about the *blue* economy (Blauwe Economie Bonaire, n.d.). In this way the concept gets a socially broadly base.

One of the innovative projects is the *Coral Restoration Project*. It is a foundation that is dedicated to restore the reefs of Bonaire. They plant coral nursery trees that grow overtime and they also initiate volunteer programs where they involve locals and tourists to help them restore the coral reefs as you can see in figure 10. The participants learn how to transplant coral and fulfil this task during a dive. In this way they participate in bringing the healthy coral and its colours back to the reef (Coral Restoration Foundation Bonaire, n.d.).



Figure 10. Volunteers helping with restoring the coral (Coral Restoration Foundation Bonaire, n.d.).

Conclusion

In this paper the current situation and the islands future have been discussed. It can be concluded that tourism has a strong influence for the wellbeing of the island and that its inhabitants become more and more dependent on the growing tourism industry. Therefore the tourism-based economy has to shift into a more sustainable economy that emphasizes on a healthy ecosystem that is already there. The questions formulated at start of this paper were:

- *Is there enough awareness about environmental sustainable development with islanders and decision makers?*
- *Is Bonaire transforming into a more sustainable, touristic-driven economy thanks to this awareness?*

The innovative company, Wolfs Company has showed straightforward what the natural effects are on the tourism industry and therefore the economy of Bonaire. They did emphasized the fact that decision makers suffer from a lack of information to underpin their strategies. With their results and advice they made the local government aware of the value of the islands nature beneficial to the economy. As an outcome the local government responded with *green* policies and in addition to this, the man Gunter Pauli has had a major influence on the island by introducing his idea of a *blue* economy, which fits the island very well. *Blue table days* are still lively today and show a lot of effective, innovative and *blue* initiatives. It is also a great way to make businesspeople, locals and other interested people enthusiastic about investing in a sustainable island and therefore the islands economy.

Bonaire is on its way to become a *blue* economy and therefore strengthen the islands present qualities. The awareness trough different layers of society are of great importance to get support for this relatively new way of thinking. Awareness of sustainable economic growth is trickling trough society and even reaches out to local residents. So yes, Bonaire is taking steps forward to make the island a better place for everyone!

Chapter discussion and conclusion

There are some important lessons to be learned from Bonaire regarding sustainable transitions. The development of the renewable energy system and the transformation to a sustainable tourist-driven economy are the prime examples. Bonaire can therefore be seen as a model for other islands and maybe even for the rest of the world. Bonaire shows that even with limited resources, an island can develop a fully renewable and self-sufficient energy system. In this way, there will be no need for fossil fuel imports, and this will most likely boost the local economy.

Tourism is however the most important factor that influences the economy of Bonaire. Wolfs Company clearly shows the impact of tourism on the local economy and environment. Together with the 'Blue economy' philosophy of Gunter Pauli, this awareness will stimulate innovative and sustainable strategies for handling the increase in tourism.

Both the transition to the renewable energy system and the sustainable transformation towards a tourist-driven economy still needs a lot of work. But this is logical as Bonaire can be seen as a frontrunner on both areas. It is therefore expected that the sustainable transitions will take time. There are however enough lessons to be learned from the way in which the transitions are being facilitated. It shows that sometimes a tragic event such as a fire can stimulate a fresh start towards a more sustainable system. The vulnerability of relying solely on one practice is highlighted in this example. The new energy system is more resilient by not depending on imports and providing more options for energy generation and thus back-up plans. The dynamics regarding tourism, economy and environment are also taken into account to guide the increasing tourism influx. This shows that local system dynamics play a large role in developing sustainable strategies.

When combining the insights of both disciplines, energy and economy, it is clear that both biophysical and socio-cultural aspects play a large role in facilitating a successful transition towards a more sustainable system. The production of algae oil has a high potential on the location of Bonaire, and local inhabitants support the transition towards increased sustainability as they are willing to pay more for sustainable options. Incentives and possibilities in other areas might be very different.

It is therefore important not to simply copy the strategies that Bonaire has chosen to increase sustainability. These strategies are especially applicable to the local situation on Bonaire. The way in which Bonaire can thus serve as a model for other areas is that every location needs a research on its system dynamics to gain understanding of possibilities for increased sustainability. Only then a successful transition will be possible. It is therefore interesting to monitor these transitions on Bonaire very closely. Lessons can be learned on the approach that is taken, and mistakes can be prevented in future transitions. Bonaire can thus serve as a model for the rest of the world on sustainable transitions when the renewable energy system and a sustainable tourist-driven economy are realized.

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Hawaii – an interdisciplinary analysis



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Abstract

In this chapter the Hawaiian archipelago will be regarded from various points of view. Although the topics are very diverse, they have one thing in common: the location of the archipelago has effects on all categories. From a historic point of view the political and military importance of its location was a major factor pertaining to the annexation of Hawaii by the United States. Being part of the US and being only accessible via plane or cruise has a great effect on the Hawaiian economy. The geographical isolation creates a unique energy infrastructure compared to the rest of the United States and therefore makes Hawaii an extremely interesting case when studying energy supply of islands. From a biological perspective being one of the most isolated archipelagoes on earth makes Hawaii an excellent natural laboratory for studying biological patterns such as convergence. Having different scientific backgrounds the authors provide an insight into Hawaii's economy, history, energy supply and ecosystem.

Introduction

Hawaii is considered to be one of the most remote archipelagoes on earth. Not only the fact that its location makes it interesting for being studied in various fields, but also other factors make it worth to have a closer look on the island. First, Hawaii has a very diverse population which is indebted by its history. In 1898 Hawaii was annexed by the United States as a result of various issues concerning the political influence of the Hawaiian monarchy. The illegality of the overthrow was acknowledged by the US in 1993. Yet, no compensations were paid and groups of the native Hawaiians still feel crucially overlooked.

The energy situation on Hawaii is covered second. Where Hawaii had to import 91% of the energy needed in 2013, it is eager to make a shift towards an energy self-sufficient future. As such, Hawaii agreed on a treaty with the U.S. Department of Energy that states that Hawaii aims to generate 100% of their electricity from renewable energy sources by 2045. It will be discussed how Hawaii's current energy systems function and how renewable energy sources could provide a future with energy self-sufficiency and what other islands can learn from this process.

Being part of the United States resulted in Hawaii being one of the best-studied islands concerning various aspects such as economy and population. From an economic perspective Hawaii's dependency on tourism will be discussed. After having lost the plantation industry, tourism became the most important sector of the Hawaiian economy. This did not come without any risks. Being dependent on other economies and only accessible via plane or ship the Hawaiian economy is very sensitive to global trends and crises.

As a typical volcanic oceanic island it has many features that make it attractive for biological scientists. Having coastal interfaces that form distinct geographical barriers and consisting of relatively small geographical entities are only some of them. In this final part of the chapter the relevance of the Hawaiian archipelago for studying the phenomenon of convergent evolution will be covered. In addition there will be a slight digression towards clarifying the current state of research regarding convergence to put the role of Hawaii in perspective within this framework.

So in summary, within this chapter the Hawaiian Islands will be examined from a historic, energy supply-based, economic and biological standpoint respectively.

Name of Island: Hawaii

Topic: Imperial interests that led to the annexation of Hawaii

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Imperial interests that led to the annexation of Hawaii

Introduction

Hawaii is the only state of the United States that is an island. In 1959 it became the 50th State of the U.S. Hawaii is not only known for its great surfing area and the so called “Aloha spirit”, but also for its diverse population. Additionally to the native Hawaiians, the Kanaka Maoli, people from different parts of the world migrated to the Hawaiian Islands at various points in time (McDermott 1980: 85). For example, Chinese and Japanese who came to work on the plantations (ibid).

There are eight main islands that belong to the Hawaiian archipelago. Next to the biggest island Hawaii, there are Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, Niihau and 124 small volcanic and carbonate islets (Fletcher/Feirstein 2010: 125). These are shown in figure 1. They all consist of volcanoes that emerged from the sea at different points in time (Price 2010: 397). The capital city of Hawaii is Honolulu with around 390.000 inhabitants. In total the islands have got a population of 1,4m people.



Figure 1: The Hawaiian archipelago, <http://aspiringwriter.ca/?=3324>

Being located 4000km away from the North American west coast Hawaii is one of “the most isolated archipelagoes on Earth” (ibid). Hawaii’s location is not only biologically interesting, but it has also been the reason for its connection with the U.S. “The great political importance of the Hawaiian Islands is mainly due to their unique geographical position” (Harmann 1895: 374). After having special trade arrangements and even a treaty that guaranteed reciprocal respect, the U.S. annexed the Hawaiian Islands in the year 1898 (Coffman 2003: 13). Before that there has been a monarchy and for a very short time the Republic of Hawaii. Although the Hawaiian Islands became part of the U.S. as a result of a referendum, the native Hawaiians still feel overlooked. The relevance to study this process becomes clear when considering that Hawaii was turned from a fully autonomous

monarchy into a state. This resulted in great changes on the archipelago, especially when it comes to the rights of the Native Hawaiians.

This essay will deal with the influence of imperial interests that led to the annexation of Hawaii. At first the historical context of the annexation will be presented. It becomes clear that the act of annexation needs to be looked at from a juridical perspective. Its illegality is stated and even recognized by the United States. There are various social movements which fight and have been fighting for restoration of the Native's culture. Finally, the social response will be discussed.

Historical context

For a better understanding of Hawaii's relation with the US today, it is necessary to gain further knowledge about their common history. Hawaii was reigned by the Kamehameha dynasty from 1810 until 1872. Kamehameha the First united the eight Hawaiian Islands through war and became the first king of Hawaii (Simpson: 87). After his death his son became the new king (ibid).

The first missionaries came from Boston to Hawaii in 1920 (Morse/Hamid 1990: 411). Throughout the years their descendants gained great influence in the agricultural production, especially in the sugar sector. This led to them having enough power to change the immigration law to their advantage. Immigrants from different countries like China and Japan came to Hawaii to work on sugar plantations as cheap labor forces. Despite of having lived in Hawaii for a long time, the missionaries still were American citizens and maintained close contact to their home country. Adding to this, America is the closest continent to Hawaii. As a result the missionaries had a strong interest in securing trade with America. On the other side, America had a strong want to strengthen the relation with Hawaii "because of its strategic interests in controlling the Pacific Ocean and extending American political, military and economic influence in the region" (Morse/Hamid 1990: 411).

When Kamehameha the 3rd was in power, the most powerful countries in the world acknowledged the independence of the Kingdom of Hawaii (Chock 1995: 463). Among them were the United States which recognized Hawaii's independence in 1842 (ibid).

In the beginning the relations between Hawaii and the U.S. were quite good. In 1849 they both signed the Treaty of Commerce, Friendship and Navigation (Chock 1995: 464). It made sure that every nation respects the other and it led to deeper trading relations. Especially the group of missionaries was very active in the trade with sugar. That is why they tried to push the trading relations between the US and Hawaii. In 1875 the Treaty of Reciprocity, a free trade agreement, was signed (Morse/Hamid 1990: 411). As a result the US did not have to pay taxes anymore when trading sugar and other goods with Hawaii. Adding to this the US gained the area of land which is now called Pearl Harbor.

Having the annexation of Hawaii already as their main goal, the missionaries wanted to expand their political influence in Hawaii. The United States had strong interest in Pearl Harbor because they aimed to increase their "commercial and military influence further into the Pacific" (Morse/Hamid 1990: 412).

In 1887 the "Bayonet Constitution" was taken in effect. The Constitution led to the Hawaiian king losing its political power. "The house of nobles had full authority over the king's cabinet, which in turn had full authority over the king" (Morse/Hamid 1990: 412). Knowing this in advance the king, David Kalakaua, refused to sign the constitution at first, but the missionaries made him to do so under the threat of death (ibid). In the following years there had been a fight over the power of the government (Kuykendall 1933: 273ff). The king tried everything that the new constitution allowed him to regain some of his power. Often this was denied by the court. In the following years many uprisings against the king took place (ibid).

In 1891 king Kalakaua died and his sister Queen Lili'oukalani took his place (Rosa 2004: 231). The Queen was pushed by the native Hawaiians and the foreign-born, whose rights were cut when the Bayonet Constitution became effective, to change the constitution (Moris/Hamid 1990: 413). She wanted to implement a new constitution that restored some of the power of the monarch. As soon as she informed the cabinet of her plans of implementing a change in constitution, they made her delay it (ibid). They needed the time to push everything they could in motion to restore the

constitution. Main actors were the missionary people who also took part in the Revolution of 1887. Several mass meetings took place and the so called "Committee of Safety", of which most of the members were European and American citizens, decided that the queen could not be granted with full confidence anymore (Kuykendall 1933: 278). As a result they decided "to put an end to the monarchy, set up a temporary government, and apply for admission into the United States" (ibid). On January 16th 1893 American troops landed in Honolulu. They were sent by the American government for the protection of the American citizens in Hawaii (Morse/Hamid 1990: 414). On January 17th the Provisional Government was proclaimed. Under protest the Queen surrendered her authority to the Provisional government (Kuykendall 1933: 278ff.). She did not attack the Provisional Government, because she did not want people to be killed. Additionally she said that the American troops arrived to protect the Provisional Government and that her troops were not strong enough to defeat them. As a result the Provisional Government sent delegates to the United States to arrange the annexation. The Queen also sent delegates to express her position. The president of the US, Grover Cleveland, sent a commissioner to Hawaii to investigate the case (Kuykendall 1933: 280). The result of this is the so called Blunt report in which it was stated that the queen had been removed from the throne illegally (ibid). He imposed to replace the Provisional Government with Queen Lili'oukalani and restore the monarchy. The Provisional Government, with Sanford B. Doyle as head, refused to do so (ibid). Knowing that during Cleveland's term the annexation of Hawaii could not be reached, the Provisional Government wanted to establish the Hawaiian Republic with Doyle as the first president (Kuykendall 1933: 281ff.). Its realization followed on July 4th 1894 after a constitutional convention (ibid). In the following years Hawaiian citizen and the Queen made attempts to restore the monarchy. After being arrested the Queen abandoned the throne and "the monarchy was dead" (Kuykendall 1933: 283). In 1896 William McKinley was voted as new president of the United States and the treaty of annexation was signed in 1897, but stopped by the Senate (Kuykendall 1933: 185). In the following years the annexation was still insecure. When the Spanish-American war broke out the Hawaiian government supported the US and "the value of the Hawaiian Islands for military and naval purposes was perfectly clear to everyone" (Kuykendall 1933: 287ff). These actions pushed the desire to annex Hawaii and this was finally done with the help of a joint resolution on July 7th in 1898 (ibid). From that day on the Hawaiian archipelago was American territory. As a result of a national referendum Hawaii became the 50th State of United States in 1959.

Legality

It has been a long way from the Hawaiian kingdom to what Hawaii is today, a part of the United States. There have always been complications and critical voices, especially when it came to the annexation. Morse and Hamid state this as follows "The Hawaiians were never asked if they wanted to become a territorial part of the United States" (Morse/Hamid 1990: 418). That is why in the following critical aspects from a juridical view will be presented.

Chock investigated the overthrow of the Hawaiian Kingdom on a juridical basis in the year 1995. The conclusion of their examination is that the US "violated international law" when participating in the "illegal overthrow of the Kingdom of Hawai'i" (Chock 1995: 512). Their main argument is that the overthrow was illegal, because it only succeeded when the US supported the small group of anti-monarchists with their troops and politically. Therefore the overthrow can be seen as an act that was not initiated by the Hawaiian people, but pushed by "foreign interests" (ibid 489). That is why the native Hawaiians have been violated in two points. First, they lost their land and second they lost their political sovereignty (ibid: 498). According to Chock they can make reclamations and demand compensation. That the US does not intend to do so is stated in the Resolution that was signed by Bill Clinton in 1993. After a centenary the US "acknowledged the illegal overthrow of the Kingdom of Hawai'i and the United States' role" (Chock 1995: 512). They also apologized to the native Hawaiian people.

Although the US recognized the illegality of the overthrow they did not intend to make any

reclamations. Still, there are groups in Hawaii that aim to regain sovereignty and get restitutions from the United States. The point is that this is not an easy issue. If one of the parties does not agree on a common arrangement voluntarily there is only one way to come to an agreement: the International Court of Justice. In this case there are different problems that have to be solved when aiming to be successful in front of the Court. First, the United States need to agree on being “bound to the court” (Chock 1995: 511). And second, “Native Hawaiians must successfully argue that they qualify as a state” (ibid). This is crucial for the accomplishment of bringing the case to Court, because “only states may be a party to a case before the court” (ibid).

In short, there are entities that state that the US participated in an illegal act when annexing the Hawaiian archipelago. Consequently, the US has to make compensations and restitutions. Although having acknowledged the illegality of the act the US does not intend to do so. That is why it seems like the groups that aim for reclamations have little chance to succeed to get the US in front of court.

Social Response

Morse and Hamid’s juridical investigation states clearly that the overthrow was an illegal act. This was even recognized by the American government in 1993 and apologies were made. Still, the Hawaiian citizens decided to become the 50th State of the US in 1959 by a national referendum. In the following some brief opinions on this action and a native Hawaiian view will be presented.

As a result of intensive migration Hawaii has a very diverse population. Since having contact with foreign people the population of native Hawaiians was heavily decreasing (Rosa 2004: 228).

According to Rosa the basic reason for the shrinking population of native Hawaiians are diseases that foreigners brought to Hawaii. Not being immune to the diseases led to many native Hawaiians dying (ibid 229). Adding to this many Hawaiians left the archipelago with sailing vessels and in hope for better opportunities. In consequence the population of native Hawaiians was constantly decreasing. On the other hand many people from a variety of countries kept immigrating to the Hawaiian Islands. Among them were American missionaries as well as Japanese and Chinese people who came to work on the plantations as cheap labor forces and also a great variety of people from other countries such as the Philippines and Puerto Rico (Kuykendall 1993: 346). This led to the native Hawaiian people being a minority on the Hawaiian Islands. For example, in 1950 “native-born American citizens constituted 84% of the total population” (Fifield 1955: 343). Nowadays only 6% of the Hawaiian population are considered to be Native Hawaiians (U.S. Statistics). Hence, the American culture had a great influence on Hawaii and many people were related to the United States. This contributed to the fact that Hawaii became the 50th state of the US in 1959 by a national referendum. Furthermore, the question “Shall Hawaii immediately be admitted to the Union as a State?” (Morse/Hamid 1990: 429) was asked. It was never mentioned that there was a possibility to regain Hawaiian independence (ibid).

In short, the great migration of native-Hawaiians led to American citizens having a great influence on the referendum which led to Hawaii becoming a State of the US. Despite having lost part of their culture, language and lands it is argued that “with statehood, Hawai’i regained a measure of control” (Coffman 2003: 354).

Particularly the native Hawaiians (and the immigrants) struggled with the introduction to the westernized world. The native Hawaiians have always been protesting against the actions from the US and the anti-monarchists. This indicates the photo below. The protests had boomed in 1993 when the annexation had lasted for 100 years. In the year a big march had taken place to remember the monarchy and the overthrow (Trask 2000: 149). Not only native Hawaiian people took part, also non-native and even tourists joined the march. The people wanted to emphasize how much they lost because of the 'Americanization' of their islands. For example the Hawaiian language was prohibited in 1896 (ibid). Adding to this the native Hawaiian lost their sovereignty, land, parts of their culture and identity. The reason for the march was the expression of their want to gain “Hawaiian self-

government” (ibid).



Figure 2 People protesting, <http://www.dmzhawaii.org/dmz-legacy-site-two/wp-content/uploads/2009/01/1831.jpg>

Haunani-Kay Trask describes the native Hawaiians as “a marginalized, dispossessed group in their own land” (ibid 150). Protesting against an action for such a long time also expresses that the people feel that they were treated heavily unjustly. Further it shows their strong desire to change the situation and restore some of the traditional aspects.

To achieve this, several movements have taken place and groups have been founded throughout the years. For example, since 1970 a movement initiated by young Hawaiians whose aim is to gain “self-government, create “a public educational system in the Hawaiian language, and legal entitlements” tries to achieve a restoration of the Hawaiian culture (Haunani-Kay Trask 2000: 150). Most of the groups particularly emphasized the importance of typical Hawaiian values such as “unity (lokaahi), a family sense of belonging (ohana), and love and care for the land (malama aina, aloha aina)” (ibid). Stressing these old values also emphasizes how crucial the loss of them was and how important they are for the Hawaiians. According to Haunani-Kay Trask the forming of these groups and the stress of the Hawaiian values lead to the creation of a “social capital” that is rooted in those values (ibid). Again, this shows that there are traditional values left that have not been commercialized and that did not vanish with the Americanization of the Hawaiian archipelago.

In summary Haunani-Kay Trask argues that the social capital led to an increase in the valuing of old traditions. This pushed the resistance and protest against the violation the Hawaiians still see themselves confronted with. Still, this did not lead to great changes in the policy nowadays and therefore Haunani-Kay Trask concludes that “social capital cannot change the dominating power of colonialism” (Trask 2000: 158).

Conclusion

The Hawaiian Islands went through a process that turned a monarchy with full autonomy into a State. Major reason for it are that the influence of the missionary's descendants grew consequently and the facilitated immigration of foreigners. At the same time diseases lead to the shrinking of the native-Hawaiian population. Nowadays their amount of Hawaii's total population is considered to be less than 10%. Hawaii became a merging point for various types of cultures.

In this essay it became clear that location can be considered as a major factor that led to the annexation of Hawaii. With its accomplishment it was possible to extend the American political, military and economic influence. That Hawaii had a strategically important position was crucially emphasized in the Spanish-American war. This also led to a stronger want to extend the control over the archipelago.

Having not only a great force from the outside, but also influence from the political decision makers on the islands the annexation was finally proceeded in 1898. This action was only possible by putting an end to the Hawaiian monarchy in a drastic way. The arrival of American military troops in Pearl Harbor outnumbered the strength of the Hawaiian troop and resulted in Queen Lili'oukalanani's surrender of her sovereignty. The illegality of the overthrow of the Hawaiian kingdom was even recognized by the US in 1993. Apologies were made, but there was no intention for making any remedies. Being such a small and powerless archipelago in comparison to such a powerful country like the US, Hawaii had little chance to resist the annexation. Adding to this, it has to be discussed if although the illegality of the act has been proven by several parties, the decision if reparations should be paid or not more or less remains a decision of the United States.

Yet, there have always been protests against the annexation by Native Hawaiian people and others. The combination of immigration from other countries, especially America, the shrinking of the Hawaiian population and the political influence that the US had over the archipelago led to great incisions in Hawaiian culture. As a result the Hawaiian Islands became a state of the United States by referendum in 1959. In the following years several groups started to fight for the rights of the native Hawaiian people and for regaining autonomy. From today's view in what extend this will be achieved can only be guessed. The example of Hawaii shows how traditional values on islands can fall victim to imperial interests of more powerful states. If we want to maintain these fragile cultures we need to deal with islands more carefully in the future.

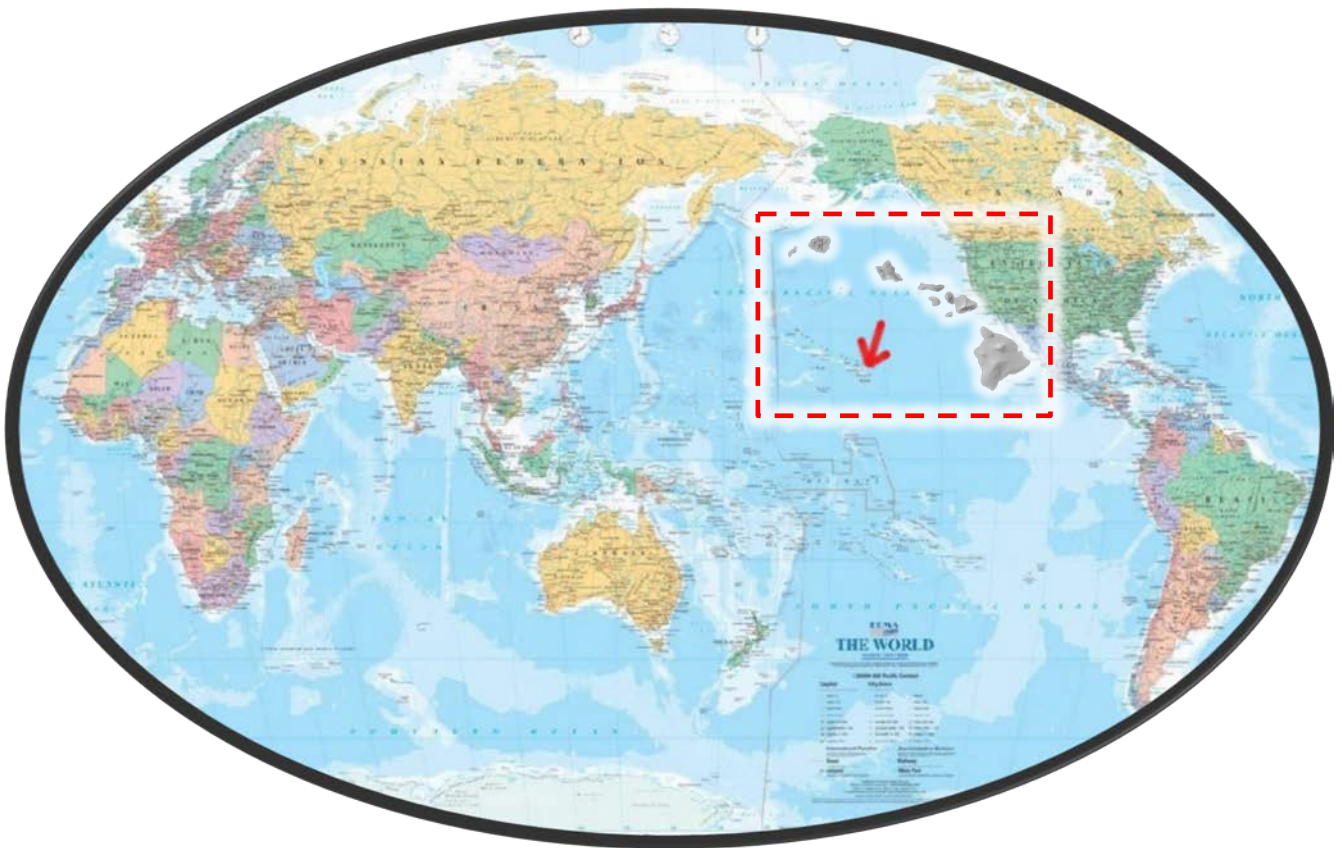
Name of Island: Hawaii

Topic: Renewable energy self sufficiency – Electricity

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Amount of words (excluding reference list): 3490 words

Hawaii: Renewable Energy Self-sufficiency?



Introduction and relevance

This paper will focus on Hawaii with regards to its quest towards energy self-sufficiency. The state of Hawaii stretches for more than 2400 kilometers, covering the eight main islands and more than 100 uninhabited reefs, atolls and shoals making it one of the largest islands chains (EIA, 2015). Hawaii is unique in its location, or isolation rather. Being located in the central Pacific Ocean, the islands chain is separated by roughly 3800 km of ocean from California, being the closest landmass. This geographical isolation from the rest of the world is creates a unique energy infrastructure compared to the rest of the United States (EIA, 2015).

The state of Hawaii has imported roughly 91% (EIA, 2015) of all its energy consumed in 2013, making it extremely dependent on external energy supplies. Roughly 90% (EIA, 2015) of the energy consumed in 2013 was fossil fuel based, 84% of the consumed energy in 2013 was sea- or airborne petroleum.

This shows how vulnerable the state of Hawaii is to fluctuations in the global oil market. This has led to the development of a partnership between the state of Hawaii and the U.S. Department of Energy called the Hawaii Clean Energy Initiative (HCEI), aimed at the development and optimization of the use of sustainable local energy sources and reduction of the state's dependence on petroleum (EIA, 2015). This led to the signing of an energy bill by the Hawaii's governor David Y. Ige that states that Hawaii aims to generate 100% of their electricity from renewable energy sources by 2045 (press release David Y. Ige, 2015). And as such, Hawaii would be the first state within the United States to set a 100% renewable portfolio standard (press release David Y. Inge, 2015).

The paradox of Hawaii's dependency on seaborne petroleum and Hawaii's abundant and variety of renewable energy sources will be take center stage in this paper.

It is interesting to investigate how Hawaii is evolving from being almost completely dependent on seaborne fossil fuels, towards becoming energy self-sufficient. It will be interesting to compare literature from different era's to illustrate the evolution in approaches towards gaining this energy self-sufficiency, mainly from a technical point of view. It will touch on the different technological implementations that are being used to achieve the goal of energy self-sufficiency.

This paper will also shed light on the unique conditions and adversities islands (states) like Hawaii have to face on their way to becoming energy self-sufficient versus cities or states that are situated on the mainland.

How is Hawaii going to realize its goal of generating 100% of its electricity from renewable energy sources by 2045? And what lessons can be learned for other islands?

Analysis and Discussion

The following chapter will be an analysis and discussion addressing Hawaii's current state of affairs with regard to its energy situation, and how it evolved to get there.

Current energy demands/dependency on non-renewables

As discussed before, the state of Hawaii is tremendously dependent on non-renewable forms of energy.

This chapter will shed light on the current ways the state of Hawaii is meeting its energy demands. Hawaii's economy is mostly tourism driven, agriculture and the United States military form other large economic drivers (EIA, 2015) When looking at the economy as a whole, one can say that it is not energy intensive. It is actually one of the lowest energy consuming economies per capita within the United States (EIA, 2015). However, the fact that Hawaii is an islands archipelago creates unique circumstances.

For instance, none of the islands are connected to any power grid. There are no undersea powerlines from any landmass connected to the existing power grids on any of the islands. This also means that there is no interisland power grid/network (EIA, 2015). This one of many examples that illustrates the degree of energy isolation the islands of Hawaii face.

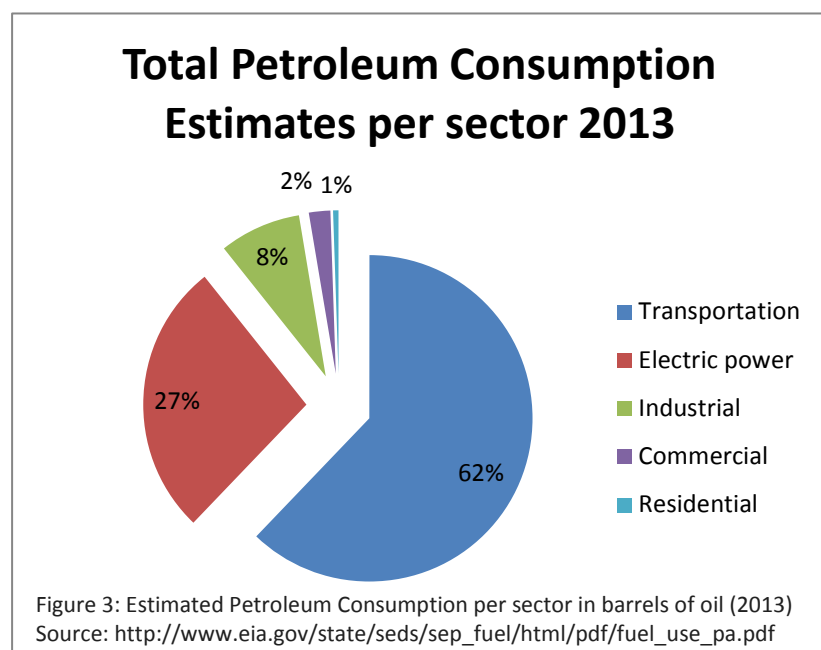
This isolation results in electricity prices that are Hawaii are the highest in the whole of the United States. Hawaii has spent more than 10% of its GDP on energy in recent years (EIA, 2015).

Petroleum

In order for Hawaii to meet its energy demands, it currently heavily relies petroleum. As mentioned before, more than 80% of Hawaii's energy demand is being met by petroleum, making Hawaii the most petroleum dependent state in the United States (EIA, 2015). As Hawaii does not produce any petroleum and also has no petroleum reserves, it imports all of its petroleum via sea vessels. Similar to the electricity grid, there is no existing network of petroleum/oil pipelines amongst the islands (EIA, 2015).

When looking at the data of 2013, the usage of petroleum is roughly divided into five sectors as shown in Figure 1.

The transportation sector proves to be the largest consumer of petroleum. Jet fuels and gasoline for ground transportation fill in roughly 80% of the transportation petroleum demands (EIA, 2015). Commercial airlines and the U.S. military are major consumers of jet fuels, making Hawaii the second largest consumer of 'aviation petroleum' in the whole of the United States (EIA, 2015).



One of the major goals described by the HCEI is the displacement of 70% of the petroleum based ground transportation fuel consumption by 2030 (EIA, 2015).

After the transportation sector, the Electric power sector consumes the largest proportion of petroleum. Petroleum fired electricity plants have generated 75% of the electricity generation, and this has been the case for the past 20 years (EIA, 2015).

However, per 2014 this percentage is dropping as the renewable energy sources are increasingly producing electricity (EIA, 2015).

This translates into 11 295 000 barrels of consumed petroleum in order to generate electricity during 2013 (EIA, 2015). To put this into perspective, figure 2 compares the absolute number of petroleum barrels consumed in order of magnitude during 2013. This means that within the U.S., Hawaii is the largest consumer of petroleum for generation of electric power. This holds true for the absolute numbers of petroleum barrels used, as well as percentage wise when compared to other states.

Total Petroleum Consumption Estimates, 2013	Transportation	Electric power	Industrial	Commercial	Residential	Total Consumption	% used for gen. of elec.
Hawaii	25,876	11,295	3,356	877	222	41,626	27,1%
Montana	20,720	1,342	7,640	436	1,711	31,849	4,2%
Louisiana	113,114	8,516	207,591	698	473	330,391	2,6%
Kentucky	172,065	3,064	33,978	3,312	5,785	111,419	2,4%

Figure 2: Estimated Petroleum Consumption per sector in barrels of oil (2013)
Source: http://www.eia.gov/state/seds/sep_fuel/html/pdf/fuel_use_pa.pdf

As the table shows, Hawaii used 27,1% of its total petroleum consumption to produce electricity. This is nearly 7 times as much as the runner up, Montana, and more than 10 times as much as the number three Louisiana at 2,6% in 2013.

When looking at the volatile history of the crude oil price, it shows great variation over the last 3 decades, with oil prices having been as low as 20 U.S. Dollars per barrel, and as high as 140\$ per barrel. This holds especially true for the last decade, marking the period between 2006 and 2016, with figure 3 displaying this great variation of the crude oil price.

All of this variation has a direct impact on the electricity prices of Hawaii, making the electricity market of Hawaii showing great variation also. Negatively impacting the market by increasing the electricity prices. On top of that, it creates uncertainty to the degree where petroleum a less and less favorable option.



Figure 3: Global crude oil prices development from 1986 till 2016
Source: created on investing.com

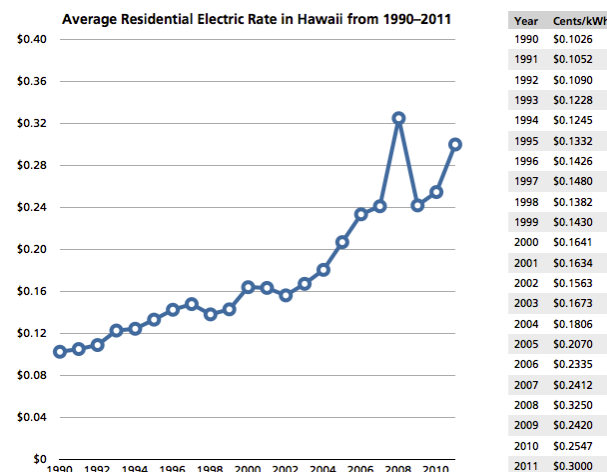


Figure 4: Average residential electricity rates in Hawaii from 1990-2011
Source: U.S. Energy Information Administration

Natural Gas

Like petroleum, Hawaii does not have any natural gas reserves and does not produce any natural gas (EIA, 2015). However it does produce synthetic natural gas also known as syngas (EIA, 2015).

This syngas is produced with a hydrocarbon mixture that is called naphtha. The refinery on Oahu forms naphtha (EIA, 2015). Hawaii is promoting the use of biomass feedstock to produce renewable based syngas (EIA, 2015). The syngas is distributed on Oahu using pipelines, there are no interisland pipelines transporting syngas among the Hawaiian Islands (EIA, 2015). The areas that are not reached by this pipeline distribution system on Oahu use propane gas that is delivered in the form of tanks (EIA, 2015).

Hawaii has the lowest consumption of natural gas in the U.S. due to these limited reserves and limited distribution capabilities (EIA, 2015).

Ever since 2014, the gas distribution system has also been used to deliver seaborne LNG imported from California (EIA, 2015). The electricity company running the petroleum fired electricity generators is investigating whether LNG would be a viable fuel partially replacing the need for petroleum to generate electricity (EIA, 2015).

Coal

Hawaii has one coal-fueled electricity generating plant on the island of Oahu (EIA, 2015). All of the coal used for this plant is imported from overseas as Hawaii does not have any coal reserves (EIA, 2015).

The coal plant has an output of 180 megawatt that produces electricity for Oahu (EIA, 2015).

Electricity

As pointed out in the previous sectors of this paper, Hawaii relies mostly on fossil fuels in order to meet its energy needs. Up until 2014, more than 70% of the electricity was generated using petroleum fired electricity plants, in 2014 this number dropped beneath the 70% mark (EIA, 2015). Wind, geothermal and biomass were the main renewable resources generating 13% of Hawaii state supply on a utility scale in 2014, combine this with consumer scale renewable electricity generation and the combined renewable generation output in Hawaii resulted in 21% during 2014 (EIA, 2015). All of this electricity is generated and supplied to six separate electricity grids, as each island has its own. Also, none of the electricity grids are interconnected to one another (EIA, 2015). Therefore Hawaii virtually has six separate electricity networks. This is inefficient when looking at it from an economics of scale perspective as explained by Prof. Dr. S. Royle (2015).

The fuel dependency and the isolated grids are partially responsible for the fact that Hawaii has the highest electricity prices within the U.S. Figure 5 displays the average electricity prices compared to U.S. average prices for the period of 2006 to 2012. As can be derived from this figure, the average electricity prices on Hawaii are up to 3 times higher than the national average.

This shows a clear incentive to improve their electric energy generation situation. The following chapter will address the renewables.

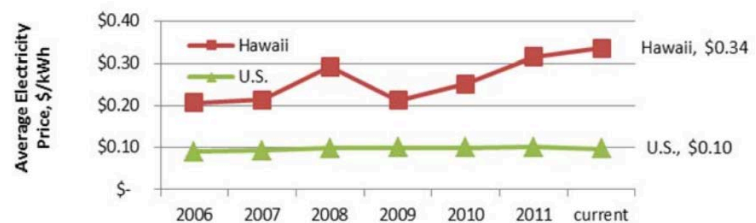


Figure 5: the average electricity prices in relation to U.S. average prices for the period of 2006 to 2012.

Source: http://energy.hawaii.gov/wp-content/uploads/2011/10/FF_June2013_R2.pdf

Renewables

This chapter will look into the types of renewable energy sources that are interesting for Hawaii, what the current status is of the renewable energy generation situation on Hawaii and also what potential renewables might have in store for Hawaii. As this paper is confined by the boundary of a limited amount of words, not all forms of renewable energy generation are discussed.

Figure 7 shows the distribution of Hawaii's electricity that is being produced from renewable sources between 2007 and 2012. Based on this data, this paper will discuss the use of wind, geothermal, and solar generating resources as the most

relevant forms of renewable energy sources for Hawaii. To elaborate, wind shows to be a substantial contributor, geothermal energy links well to the islands nature of Hawaii and solar shows to be rapidly growing and seems to have a lot of future potential.

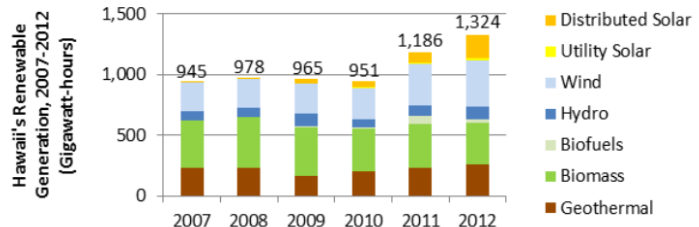


Figure 6: Hawaii's renewable generation from 2007 to 2012 per sector. Source: http://energy.hawaii.gov/wp-content/uploads/2011/10/FF_June2013_R2.pdf

Goals - HCEI

Starting off in 2009, the legislators of Hawaii aimed at creating 40% electricity from renewable energy sources by the year 2030. This number was later increased to 70% by 2040. During 2015, the aim was set to a 100% by the year of 2045. And this is a significant goal, since Hawaii would become the first state within the United States to obtain a 100% Renewable Portfolio Standard (RPS), supplying their electricity demands by generating electricity solely from renewable energy sources (EIA, 2015).

Besides setting its sight on the generation of renewable energy, Hawaii has also committed itself to becoming more energy efficient. This resulted into the Energy Efficiency Portfolio Standard (EEPS). According to the Hawaii state office report (2013), Hawaii aims to conserve 30% of its annual electricity sales statewide (EIA, 2015).

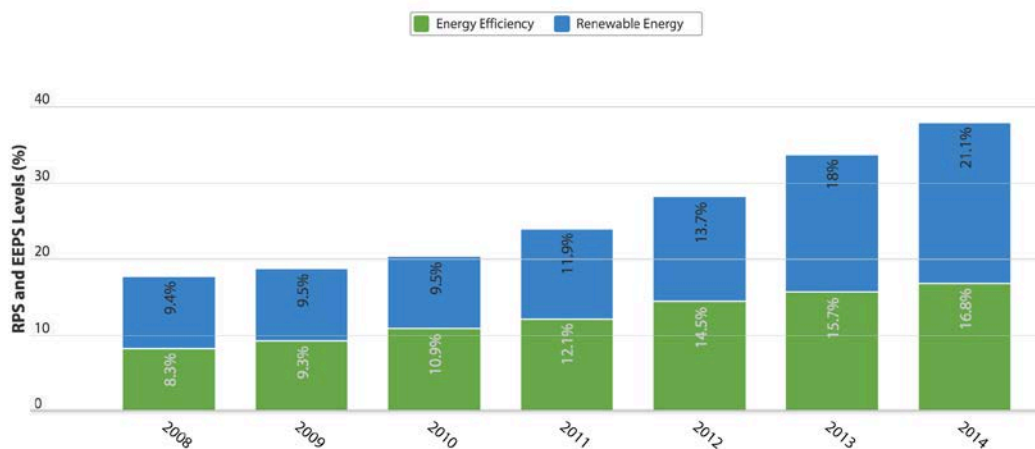


Figure 7: Hawaii's RPS and EEPS levels from 2008 to 2014. Source: <http://energy.hawaii.gov/resources/dashboard-statistics>

Wind

The situation with regards to wind energy generation is somewhat unique on Hawaii. This has to do with the fact that Hawaii is an island state located in the middle of the Pacific Ocean, but also with the actual geomorphology of the islands' coastal areas. The exact location of the Hawaiian Islands makes it so that they are favored by the northeast trade winds as can be seen in figure 6 (Shupe, 1982). These winds blow across Hawaii approximately 3 quarters of the time, making it one of the most consistent and reliable wind patterns in the world (Shupe, 1982).

These favorable conditions are reinforced by the geomorphology of the island and a stable inversion layer hovering at roughly 1800m. This creates a funneling effect, increasing the wind velocity greatly and often more than doubling the wind velocity (Shupe, 1982).

Furthermore, the absence of icing conditions and extreme winds such as hurricanes make it the state of Hawaii has ideal conditions for the generation of wind energy (Shupe, 1982).

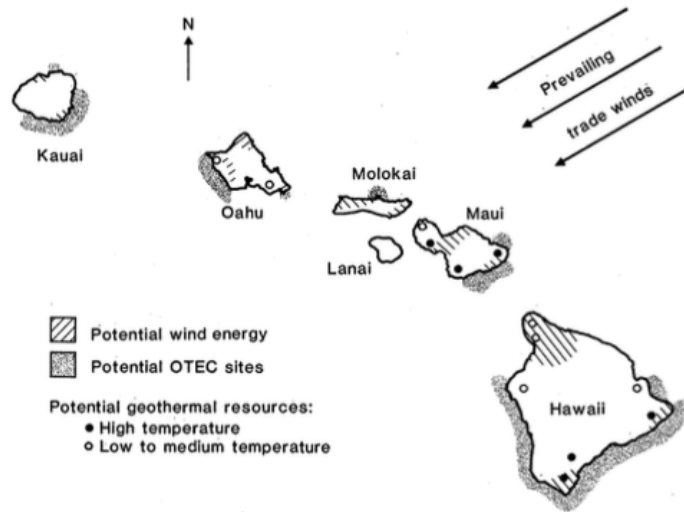


Figure 8: Inventory of potential wind, OTEC and geothermal resources in Hawaii
Source: https://facultystaff.richmond.edu/~sabrash/110/Energy_Self-Sufficiency_For_Hawaii.pdf

Using 1982's numbers it was estimated that during trade wind conditions, the wind energy potential was 10 times larger than the entire electricity demand in the state of Hawaii at the time (Shupe, 1982). The infrastructure chapter will address some of the challenges that wind energy generation faces.

Solar

The Hawaiian Islands are situated between 19°N and 22°N latitude, Honolulu experiencing sun only 3°N of vertical during midsummer and only 45° above the southern horizon during winter low. This translates into a high average insolation rate with little seasonal variation (Shupe, 1982). These form ideal conditions for solar energy generation, resulting in annual average insolation rates in excess of 500 calories/cm² per day (Shupe, 1982).

Due to these favorable conditions, the high electricity prices, and progressive energy policies solar energy generation as percentage of the renewable energy generation is on the rise as shown in figure 9 (Hawaii state energy office, 2013).

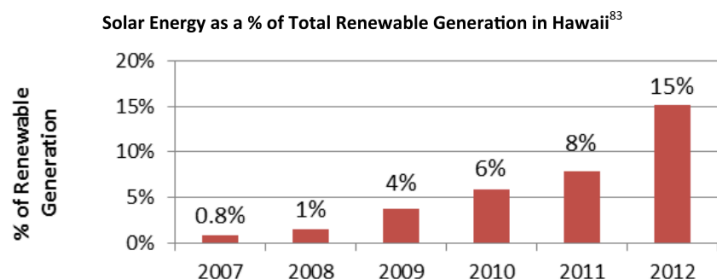


Figure 9: Solar Energy as a % of total renewable Generation in Hawaii 2007-2012

Source: http://energy.hawaii.gov/wp-content/uploads/2011/10/FF_June2013_R2.pdf

As of 2013, 24,000 photovoltaic systems (PV's) have been installed, providing a total of 223 MW in solar energy generation capacity (Hawaii state energy office, 2013).

To understand the cumulative output of the photovoltaic solar systems, one has to factor in the capacity factor. This factor creates a realistic picture of the actual electricity output of the maximum capacity output, as the sun does not shine 24/7, nor does it shine with the same intensity. Hence, the capacity factor. For solar, this capacity factor was roughly 20% according to the Hawaii state energy office (2013) during the year of 2012.

The capacity to generate solar energy is increasing due to the implementation of the technology by consumers in commercial institutions, respectively referred to as distributed solar and utility solar. Not only the capacity is increasing, also the efficiency rates are still increasing every year, as new technologies are developed and older technologies improved.

Figure 10 shows the development of the different solar cell technologies over the last 40 years. As can be derived from this graph, efficiency rates currently vary from 10.6% to 46% efficiency, depending on the solar cell technology that is implemented.

Besides the increasing efficiency rates, making it more and more sensible for consumers and enterprises to use solar generation to provide them with electricity, the government is creating incentives to encourage people to go solar. Per example, the government is implementing net metering programs, which makes it possible for solar system owners to 'sell' the solar generated electricity that cannot be used due to overcapacity, to the grid (Hawaii state energy office, 2013).

This holds promise for the future of solar generated energy, which is reflected in the rapid increase of solar energy share of the total share of renewable generation. However, there are challenges to overcome concerning solar energy. These challenges will be addressed in the Infrastructure chapter.

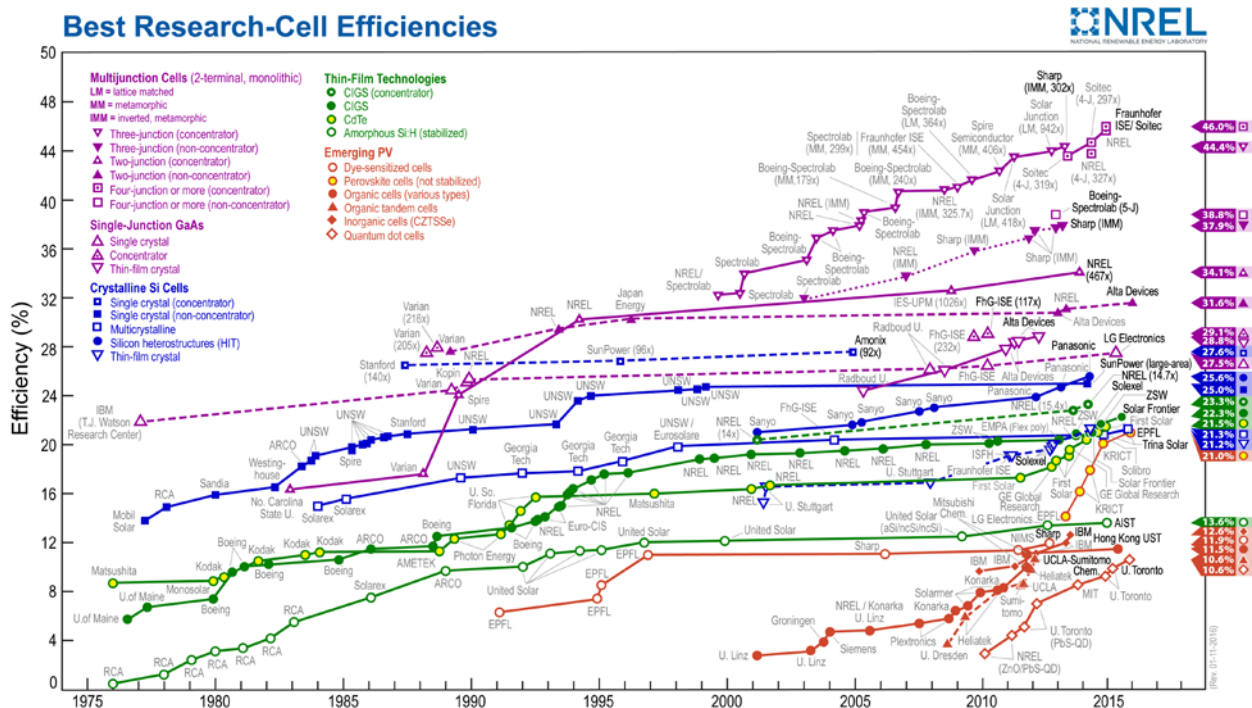


Figure 10: Best Research-Cell efficiencies of photovoltaic systems
 Source: <http://rsta.royalsocietypublishing.org/content/369/1942/1840>

Geothermal

As Hawaii is situated on top of a volcanic hotspot, it is actually situated on top of a big bulb of potential energy. Geothermal energy. When speaking of geothermal energy one talks of the energy that is contained as heat in the earth's interior. This energy can be used to generate electricity. To investigate the potential of geothermal energy on Hawaii, scientist have been researching and creating methods to harvest this energy potential during the 20th century (Shupe, 1982). The first experimental research well showed promising results in 1976. At the time it was one of the worlds hottest geothermal wells with temperatures of 358C° being measured. Also, the quality of the fluid and the toxin levels proved excellent (Shupe, 1982).

This has led to the development of the single geothermal power plant going by the name of Puna Geothermal Venture.

Generally speaking, they found that the efficiency rate of the electricity that is produced using geothermal energy varies from 10-17% (Barbier, E., 2002). However, the Puna plant has a significant output, resulting in 266 gigawatt-hours during 2012 (Hawaii state energy office). This translates into 23% of the total electricity consumed on Hawaii and amounted to 20% of the total renewable energy generated statewide during 2012 (Hawaii state energy office, 2013).

Geothermal electricity production is relatively cheap and competitive when compared to the petroleum-generated electricity and is generally perceived to be one of the cheaper forms of renewable energy according to the Hawaii state energy office (2013).

On the Islands of Hawaii and Maui proposals have been drafted to generate a further 50MW and 30MW of electricity respectively, as this would allow one fossil fuel refinery to be replaced by a geothermal power plant (Hawaii state energy office, 2013).

Current geothermal Production Capacity in Hawaii	38 MW	Contracted price for first 25 MW of electricity from PGV ⁵⁶	20.6¢ on peak 15.4¢ off peak per kilowatt-hour (kWh)
Estimated probable reserves, Maui & Hawaii	1,000 MW	Contracted price for next 5 MW	11.8¢ / kWh
Levelized cost of geothermal energy ⁵⁷	4¢ - 14¢ per kWh	Contracted price for next 8 MW	9¢ / kWh

Figure 11: Overview of Geothermal facts
Source: http://energy.hawaii.gov/wp-content/uploads/2011/10/FF_June2013_R2.pdf

More research will be done to further investigate Hawaii's geothermal power potential. Research done during the 1980's indicated that the potential was upwards of 1000MW (Shupe, 1982). According to the Hawaii state energy office (2013), this would amount to more than 200% of the Renewable Portfolio Standard goal.

Infrastructure

As mentioned before, Hawaii has serious potential with regards to renewable energy generation. However, in order for this potential to be realized, the islands of Hawaii have to invest in infrastructure. As of currently, the islands independently only provide their own electricity needs. The individual electricity grids of the islands are not interconnected, nor are there any other interconnected pipeline networks among the islands.

With the intermittent nature of the renewable energy sources' output in mind, it is critical to develop an interconnected electrical network as to distribute and coordinate the electricity supply and demand in an efficient manner.

There is also a need for the storage of electricity, a battery system. Creating electricity storage systems using batteries would address some of the challenges. This way, overcapacity can be stored and will benefit a more efficient electricity system.

Conclusion

Currently the state of Hawaii is predominantly depended on fossil fuels. This makes Hawaii vulnerable to fluctuations of the global oil market. The fact that Hawaii is an island state that is separated by 3800 km of ocean from the nearest mainland creates unique challenges.

The climatic conditions on the island in combination with the other favorable conditions that can be used to generate renewable electricity make for a great renewable energy generation potential. Paradoxically, Hawaii's dependency on seaborne petroleum is high and as a result of this the electricity prices are the highest in the entire U.S., up to 3 times the national average.

To combat these issues and enable Hawaii to take full advantage of its vast renewable energy potential, the HCEI was created. Its goal is to create an energy portfolio that consist of 100% electricity generation from renewable energy sources by 2045, combined with an increased energy efficiency of 30% by 2030.

In order for Hawaii to achieve this goal it turns to renewable energy sources, being primarily: wind, solar, geothermal, biomass and OTEC. The islands have geographical and geomorphological features that favor the renewable energy generation potential for each of these forms of energy generation. Resulting in a situation where almost each of the individual renewable energy sources mentioned above, are capable of generating enough energy to provide the island state with its 100% renewable electricity goal. Whether Hawaii will meet this goal in time though, is another question.

However, in order for this potential to be realized, the islands of Hawaii have to invest in infrastructure. As of currently, the islands independently only provide their own electricity needs. The individual electricity grids of the islands are not interconnected, nor are there any other interconnected pipeline networks among the islands.

With the intermittent nature of the renewable energy sources' output in mind, it is critical to develop an interconnected electrical network as to distribute and coordinate the electricity supply and demand in an efficient manner. Also, there is a need for the storage of electricity, a battery-like system.

All in all, an electrically energy self-sufficient Hawaii seems feasible. Whether Hawaii is capable of reaching their goal HCEI goals on time however, is a question only the future can answer.

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Hawaii's dependency on tourism – a threat?

Introduction

Already in the 1990s, the 50th state of the United States of America was in the focus of researchers. Hawaii is one of the best documented islands including its economy as it is part of one of the most powerful countries in the world. Today, Hawaii's biggest challenge is its shortage in living space, a typical problem innate to small islands (Royle, 2012, p. 251). The increasing flow of incoming tourists demands a rise in the amount of accommodations. With new hotels being built and apartments being rented to tourists, space becomes even scarcer. Consequently, the price of sustenance for the local population increases enormously. Right now, food and rents are comparably higher than in the rest of the U.S. (Reinhold, 1993).

For most of its time, Hawaii has been struggling concerning its economy. No clear structure was detectable in the past and every once in a while it seemed like the overall economic strategy was being changed. First, the plantation industry was the main contributor for the state's economy. Following that, efforts were made to shift the attention towards tourism as islands were promoted as the most favorite destinations (Baldacchino, 2006, p. 5). Due to several crisis and events that threatened the long term success of the state, new alternatives had to be considered. In recent years, the process of economic diversification began to flourish (Reinhold, 1993).

Already in 1992, the state of Hawaii started to overthink its economic structure. There was a point in Hawaiian history about ten years before, when it was decided that the focus should not lie on the plantation industry anymore but shift towards tourism. Sugar and pineapple plantations were replaced by golf courses to lure foreigners, mainly Americans and Japanese onto the islands. Hawaii was depicted as paradise on earth, an image which still remains today in the minds of many. The original plan was to aim for a doubling of tourism during the next decade but a debate started if that really was the desirable goal to achieve. However, the environment and sustainability were not taken into account; tourism was and kept being the most important economic sector. A decade later the amount of incoming tourists hit rock bottom. This led to a new strategic approach: instead of only focusing on the sector of tourism, economic diversification came on the table as a new idea (ibid).

Following, it will first be looked at the structure of the economy of Hawaii and its key drivers comparing the past to the present which will put the focus on the tourism industry. After that, it can be seen that the dependency of the island on other economies' well-being involves a certain risk. Furthermore, the accessibility only by air transportation also embodies a problem which will be illustrated by a significant example. Eventually, a possible alternative for accessibility will be introduced and critically evaluated. All these insights will help to answer the overall question if the state of Hawaii is in fact dependent on tourism and if so, must it be considered a threat?

Analysis

Transition of the Hawaiian economy towards tourism

Similar to many other countries, the agricultural sector played the most important part in Hawaii's economy in the 20th century. Most successful were huge plantations growing sugar and pineapples. They were dominating the market and made it possible for Hawaii to export its goods to the rest of the world (Vitousek et al., 2004, p. 1666 – 1669). This branch was deeply rooted in the islands' society comparable to the steel and mining industry in Northern England. Families were strongly connected to their workplaces and identified with them. Their work gave them a meaning in life and traditionally, jobs were passed on throughout generations in families. However, with the mechanization of production cycles and new inventions replacing human workforce this economic branch had to face its end (Boyd, 1996, p. 96-97).

In 1992, the majority of plantations started to lay off their workers. Some of those companies moved to places with lower labor costs like Thailand. Other companies just shut down their businesses. This resulted in a rising unemployment rate among the workers of the islands. Their longtime secure job providing industry just broke down leaving them behind looking for a new place to work for. Until this point in Hawaii's history, unemployment always had been a result of crisis regarding the complete economy. Now, the loss of work opportunities challenged the structure of the existing economy (ibid).

With no work at hand, people had to look for new opportunities and many of them turned towards the sector of tourism. However, not without making huge compromises as the plantation workers often did not want to change jobs. Additionally, some of them were not native English speakers and they did not bring what it took to work in the service industry. Nevertheless, the sector of tourism flourished and caused a split of Hawaii, dividing it into the wealthy Western and economically challenged Eastern side (ibid, p. 106-109).



Figure 1. Hanauma Bay
(hawaii.gov, 2015)

Tourism soon became the key economic sector of Hawaii. Several reasons could be named but particularly the islands' image contributed to its success. The destination is known for its 'aloha spirit' offering visitors the chance to fully relax and make the best out of their holidays. Formerly, Hawaii was a destination for only the upper class of society. Throughout the 20th century, most visitors came to enjoy the empty beaches, experience the unique culture and spend time doing leisure activities like playing golf. With time and dropping prices for air travelling, a common phenomenon of tourism took place: the middle class followed the 'rich and famous'. This soon made the state of Hawaii turn into a place of mass tourism with about seven million tourists arriving every year.

Special about this destination is its image: a paradisiacal climate combined with impressive nature providing crystalline beaches, active effusive volcanoes, rain forests and much more. Visitors can enjoy activities like shopping, diving, and hiking and every year the possibilities are being extended. Most people visit to experience the laid-back aloha spirit and enjoy what they depict as paradise (Spencer, 2012, p. 536-357).

Economic dependency

Hawaii's economy is hugely connected to the well-being of other economies. The two most important players are the mainland of the United States as well as Japan. Most business cooperation projects and transactions are being made with one of these two countries as partner. Therefore, the course of the yearly economic success is unsurprisingly similar to theirs. In years of tremendous crisis, for example in 2009, Hawaii's economy did not do well and had to face serious recession. When looking at various data from the past three decades, the link or better said one-sided dependency is supported. For example, the Gross Domestic Product can be taken to show that the overall course of all three parties is aligned in its average portrayed in the graph (Tian, 2014, p. 9). The Gross Domestic Product is a popular indicator to show the economic well-being of a country. It represents the total of all goods' and services' produced economic value in a certain period of time. The GDP is often used as it makes comparisons in between countries possible and can give a feeling about the health and living standard in an area (Investopedia, 2015).

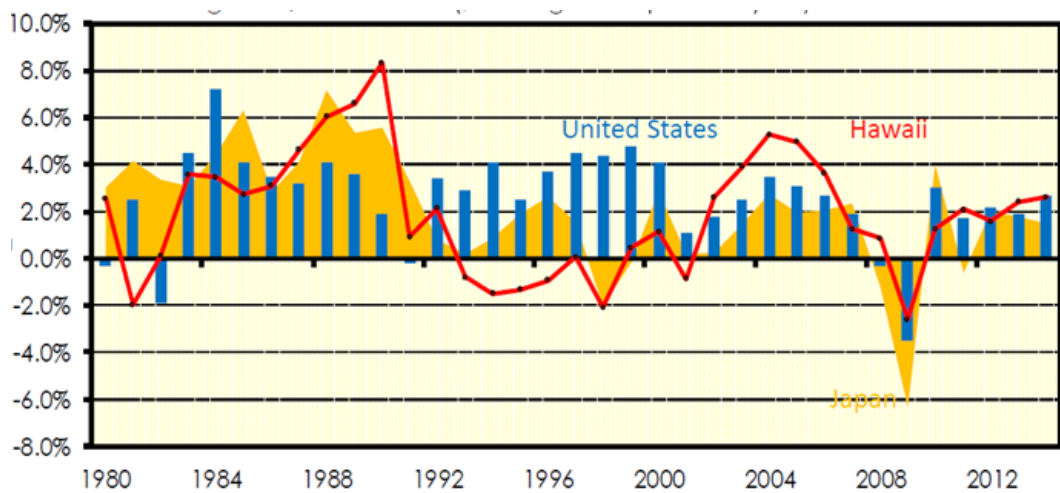


Table 1. Real GDP growth from 1980 to 2014 in percent showing the change from the previous year (Tian, 2014, p. 9)

Unsurprisingly, not only the overall economy is hugely affected by the ones of the United States and Japan but also the sector of tourism. Those two countries represent the regions where most visitors come from every year. They form the top two target groups and together make up to about 80 percent of all visitors. When taking a look at the absolute numbers, in 2010, about 4.59 million people of the United States spent their holidays on the islands of Hawaii. In second place is Japan with about 1.24 million visitors (Spencer, 2012, 537). However, worth noting is the fact that those two groups have a relatively stable amount of arrivals without oscillation. This is an advantage as they can be expected and relied on but on the other side, there is no real opportunity to increase the yearly profit as the capacities are already efficiently used. Opposed to them are the nations providing only little numbers of visitors. For example, tourists from China and South Korea are only a small percentage but when looking at the growth rates the difference is tangible. Tourism from China had a growth rate of about 140 percent between the years 2006 and 2013 and Korea even 350 percent of a change. In comparison, Japan's amount of arrivals only grew about 11 percent. Experts are also noticing this increase of tourists in smaller markets and think it is worth building future strategies according to those trends (Tian, 2014, p. 38 - 40).

Economic instability due to geographical isolation

Tourism is largely dependent on the current state the economy is in and can be influenced by unforeseeable incidents like natural disasters or terror attacks. When accepting the fact that tourism is the key basis of Hawaii’s economy, it becomes clear how easily this could be threatened. Hawaii is one of the most remote islands on planet Earth with its nearest coast 3862 kilometers away (Spencer, 2012, p. 535). When tourism is the main driver of people’s well-being in terms of jobs and payments, one must look at the risks that are present as well. Hawaii being an island limits its access by tourists to only a few means of transportation (Hay, 2006, p. 21 – 22). Most of its incoming visitors come by plane via the airport of Honolulu on the island of Oahu. Alternatively the island can be reached by boat like cruises would do. However, this is only a marginal percentage of all people arriving. This seemingly inferior mode of transportation could however be utilized more effectively.

Coming back to the easiest and most common way of accessing the state of Hawaii: air transportation. This limited mode of access leads to a dependency of the islands on a well-functioning air traffic system. As soon as a single problem in this system occurs, the connection to the mainland can break down. This would mean that no new tourists are able to reach their destination, leaving Hawaii without their source of employment and thus income. Depending on the seriousness and period of the breakdown, this would have enormous consequences for Hawaii’s economy.

One famous example in the recent years is the terror attacks of 9/11 when the World Trade Centers and the Pentagon were targeted which led to a huge market shock around the world. Its consequences also had an impact on the state of Hawaii. It showed the effects of a global occurring event challenging the reliance of Hawaii on tourism.

Several short and long-term effects were noticed: most visible were the job losses in sectors connected to the tourism sector only a few weeks later. After the attacks, the air connection was stopped completely for two days which led to a standstill of the economy. Especially the tourism sector was affected due to a profound and immediate fall of visitors’ arrivals. Following that were cut backs by airlines in the available amount of flights that went up to twenty percent in specific cases. However, not only the airlines took action but also travelers cancelled or rescheduled their flights (Bonham & Gangnes, 2001, p. 2 – 10). The graphs clearly show the immediate downturn, reaching its lowest point at the end of September. Interesting to note is the fact that the number of arriving passengers from international flights is significantly lower compared to domestic flights. This phenomenon can be explained by the fact that visitors coming from abroad are mainly traveling out of business reasons or are going on holidays. Therefore, their trip is rather exceptional and inhibitions and resistance are higher. The local population, making up the passengers of domestic flights, see their travelling more as a routine or necessity when for example, changing in between islands (ibid).

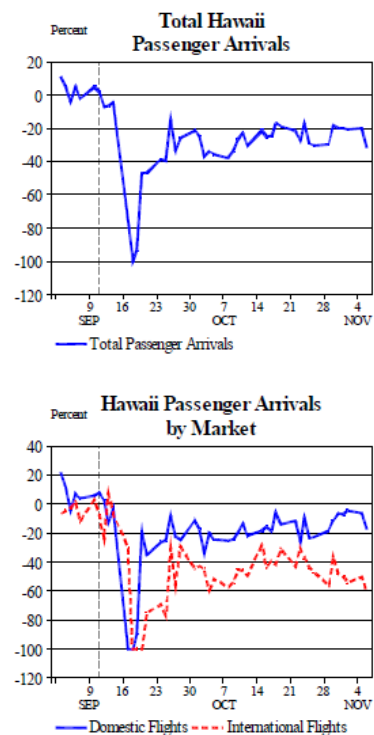


Table 2. Passenger Arrivals over the years (Bonham & Gangnes, 2001, p. 8)

Empirically measured as well could be the claims for unemployment insurance. Already in the following month, they exponentially rose to about 17000 claims within thirty days including people having lost their employments as well as hours being cut (ibid).

The consequences were not only a loss in jobs in the tourism sector concerning companies providing accommodation, transportation and connected retail industry but also a falling income in the remaining work placements. Those effects are direct consequences of the diminished profits being made by the incoming visitors as both business and consumer spending downturned (ibid).

Fortunately for Hawaii, the human mind is relatively forgiving and forgetting. When looking at violent attacks that cause lot of horror among the population, it can be seen that crucial changes in travelling behavior are only tangible for a limited amount of time. The human perception is programmed to lose negative images caused for example by terror attacks really quickly. Empirical statistics proof that by the year 2003 the tourism industry of Hawaii had fully recovered. The initial drop in visitors went back to its normal level and the air travel works at its daily pace again (Cornwell & Roberts, 2010, p. 1 – 3).

The cruise industry as a part of economic diversification

The market segment of cruises is one of the fastest growing industries in the tourism sector. When looking at islands, the arrival by ship is good alternative to air transportation. Hawaii also considered this option when thinking and developing a good mixture of economic diversification.

In the year 2010, 1.4% of all visitors arriving on the islands of Hawaii came by cruise ships as their means of transportation (Spencer, 2012, 537). This percentage is not a lot however, the market segment must be looked at from a broader frame.

The number of people going on a cruise is rapidly increasing over the last few years without any change in sight in the near future. Ships are fully booked and cruise lines expand their fleets by ordering more ships in the big shipyards of the world. The United States of America is the nation with the most people going on a cruise every year. About 80 percent of all passengers on ships are coming from the United States. The destinations of cruise lines vary but Hawaii is under the top ten every year. Among the top five rank destinations mainly situated in the Caribbean, Alaska or Mexico. Hawaii is in that regard disadvantaged. In relation to the North American continent are the former destinations much closer in distance. Therefore, the amount of time on board reaching the destination is much shorter. Hence, passengers favor these trips in comparison to Hawaii. The latter destination demands more time to reach due to its remoteness (DBEDT, 2004, p. 4-10). Nevertheless, the tourist segment of cruises draws new profit to the state of Hawaii. Those can be the revenues made from tourists visiting the islands, crew and other employees on board and additionally, fees and taxes demanded by the Hawaiian government (ibid). Interesting to mention is also the fact that most cruise visitors are 'repeater' meaning that they have been there before and will come again. This is a good characteristic of this growing economic niche and helps to convince companies to invest for the long term (ibid). Ultimately, the extreme remoteness of the state of Hawaii is a disadvantage in this context. Therefore, this segment can never be as impactful as its competing air lines. Nevertheless, it is an opportunity to make a step towards a new segment providing revenues for the tourism economy.

Conclusion

Summarizing, it can be stated that Hawaii's loss of the plantation industry resulted in tourism being the most important sector in economy. Learning from the past and taking academic research into account, it is safe to say that it will also be the main contributor in the future. When looking at it critically, it could be seen that one must pay a certain price for it.

The reliance on tourism is an imminent risk which is dependent on external factors. The sector's success is hugely influenced by global trends or crisis. As soon as something happens in another world country's economy, the business going on in Hawaii is feared to be impacted. However, it is not only the dependency on tourism that embodies a constant threat to the state's economy. Additionally, academic experts and political leaders slowly begin to realize that the islands are not invulnerable and have a distinct threshold of resilience as well (Scheyvens & Momsen, 2008). Naming only a few examples – millions of tourists visiting every year result in overcrowded beaches and hotels. The little developed transportation system is at its limits and energy as resources on Earth are not endless. The local population is in competition with the tourists for living space which leads to a peak in housing prices every year (Benson et al., 2015).

Compared to other islands, Hawaii is still in a good situation due to its connection to the mother country, the United States. Unemployment rates are at a bearable level oscillating between about six and nine percent. Important to note is also the fact that the majority of used resources are imported (ibid).

Due to its insularity the economy is even more dependent on the outside world than other countries that border several other states. A closer look at the flows of energy, goods and materials can give more information about the balance of income and outcome. The fact is that in 2008 more than 75% of the state's primary energy, electricity and fuels needed for transportation were based on oil. This again presents a dependency on other suppliers which carries a certain amount of risk. Those risks can also be tied back to the tourism industry for example, when oil prices rise which affects the money being earned in companies of the tourism sector (Spencer, 2012, 537).

In the future, Hawaii will take more advantage of possible niches to develop more alternatives in the tourism industry. The cruise industry was only the first step in the direction of economic diversification to limit the risks of a possible economic recession caused only because of the dependency on other countries' economies.

Convergence in the Pacific, out of the blue

The pattern of convergent evolution and the relevance of the Hawaiian archipelago for studying this phenomenon

1. Introduction

1.1) Introduction to convergent evolution

Convergent evolution is of vital importance in understanding the striking diversity that evolutionary processes have generated since the advent of life on earth (Stayton, 2015). Convergence can be defined as the independent development of phenotypic similarity in multiple lineages, without being present in the most recent common ancestor (MRCA) (Losos, 2011). This pattern is often thought to be the result of adaptation in response to nearly identical extrinsic selective factors, a process governed by natural selection (Losos, 2007).

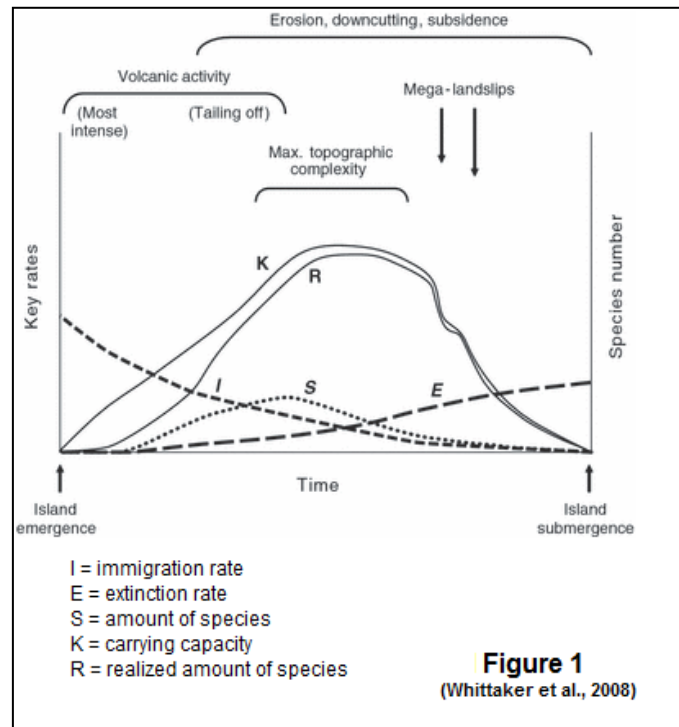
During the last decennia research regarding the genetic underpinnings of convergent evolution has blossomed because of advances in DNA sequencing techniques and data analysis (Losos, 2007). These developments have made it possible to construct phylogenetic histories more accurately and analyze the subsequent data through the application of complex algorithms. Recent research is mainly conducted to pursue the goal of understanding the predictability of evolutionary patterns and thus determining the nature of limits on evolution (Losos, 2011; Stayton, 2015).

1.2) The relevance of the Hawaiian Islands for the study of convergence

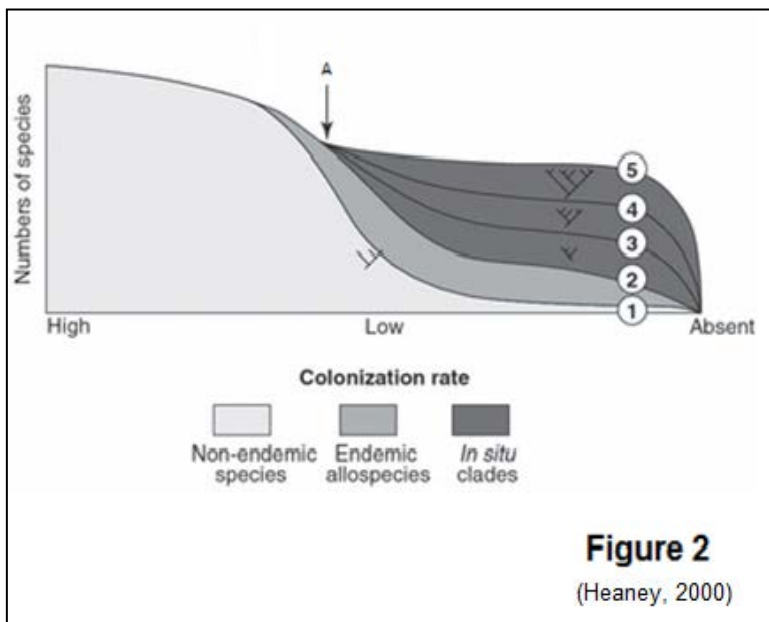
As the Pacific Plate has moved in northwestern direction over the stationary Hawaii hotspot for the past millions of years it has left a chain of islands in its trail (Olson, 2004). Today this collection of islands form the Hawaiian archipelago, a classic example of volcanic oceanic islands. These islands possess numerous innate features which make them an excellent 'natural laboratory', suitable for studying biological patterns such as convergence. Firstly, this island group forms the most remote archipelago in the world, removed over 3500km from the nearest continent (Baker, 2009). Their isolation guaranteed a marginally low immigration rate before the interference of humans. Secondly, the coastal interfaces of the Hawaiian Islands form distinct geographical barriers (Fernández-Palacios, 2010). This marine barrier limits the transfer of genes with the continents and even between separate island populations, especially in species with weaker dispersal abilities. Thirdly the islands consist of relatively small geographical entities so the species diversity can be mapped more easily and the biological complexity is lower (Fernández-Palacios, 2010; Emmerson, 2002). Finally, regardless of their more simple biological structures, islands eventually develop a rich biodiversity because they are prone to a high degree of vicariance due to a geophysically active environment. Vicariance is a process which divides existing populations through geographical barriers and prevents any gene flow between these novel subpopulations. After a sufficient amount of time passes this phenomenon promotes the formation of new species through cladogenesis. The formation of two separate species from a common ancestor, generating a new clade (Cowie & Holland, 2006).

A vast amount of vacant ecological niches become available on oceanic islands after their ascent and after erosive forces have maximized topographic complexity. The accretion of terrestrial area on the Hawaiian Islands corresponds with an increase in niches. This in turn leads to an expansion of the maximum theoretical amount of species that can be sustained, also known as the carrying capacity (Figure 1, K) closely followed by the actual amount of species (Figure 1, R). When, due to isolation, the immigration rate happens to be sufficiently low like on the Hawaiian archipelago, endemic species and consequently endemic clades will form (Whittaker et al., 2008). Endemic species are unique to a specific geographical location, which in this case consist out of islands (Fernández-

Palacios et al., 2015). The process of cladogenesis was found to occur more consistently after the mean velocity of gene flow falls below one individual per generation (point A, Figure 2) (Heaney, 2000). At this point, on average, less than one individual will arrive within the time it takes before two individual organisms from this species reproduce. This results in a less diverse gene pool. This means there is less genetic variability throughout a population of species (Dawkins, 1978). This increases the extinction rate and subsequently those individuals best adapted to the various open ecological niches on the island will survive to establish new distinct populations.



Over a considerable length of time the partition of species consisting of in situ clades will exceed the number of both endemic species and non-endemic species (Figure 2). The oldest clades become incrementally more species-rich as time progresses (space in between 3 and 5, Figure 2) (Heaney, 2000). Primarily allopatric speciation will result in the formation of new clades (Olson, 2004). This type of speciation occurs when two populations of the same species become reproductively isolated. At the moment speciation happens fast enough, like on the Hawaiian islands, because of the ecological opportunities facilitated by the availability of many niches an adaptive radiation comes into existence (Losos, 2007).



Species in an adaptive radiation look similar although they are often still morphologically distinguishable. The formation of adaptive radiations on archipelagoes is significant for the study of convergent evolution. It often happens that species from an adaptive radiation of an older island colonize geologically younger islands after which new adaptive radiations of the same species are initiated (Fernández-Palacios, 2015). These species then evolve in respect to similar environments generating convergent phenotypes which can

be studied for a deeper understanding of this phenomenon. It so happens to be that the Islands of Hawaii are the archipelago richest in this type of radiation (Lerner et al., 2011).

Understanding the origin of evolutionary diversity is important in any strategy aiming to conserve biodiversity. This task poses a serious challenge as climate change, habitat fragmentation and other anthropogenic influences are threatening the existence of numerous species (Powell, 2009). Convergent evolution is a pattern caused by a number of processes which could help determine the

limits to diversity. The main points discussed in this paper are (1) the definition of convergence; (2) the study of convergence; (3) case studies of convergence on Hawaii; and (4) the implications of convergence (repeatability vs. contingency). These points are all relevant in making sure the findings of studies on convergent evolution are coherently integrated in the broader study of evolutionary biology.

2. Defining convergent evolution

An essential duality exists between definitions which define the phenomenon of convergence. The first definition recognizes it as a pattern (process-neutral) and the second class specifies convergence as a pattern caused by a specific mechanism (process-based) (Stayton, 2015). Pattern-based definitions do not infer any mechanism to be responsible for convergence and therefore encourage scientists to keep searching for novel explanations aside from the already assumed processes like natural selection and differences in developmental constraints (Stayton, 2015). In addition process-based definitions are incompatible with convergent patterns that are not generated by any phenomenon. These primary inconsistencies have considerable consequences for the study of convergence as it alters the way in which convergence is measured. This in turn can have serious implications for what can be inferred from the abundance of convergent patterns that have been found. Accordingly process-neutral, also referred to as pattern-based definitions, are more functional in researching convergence.

This dichotomy is accompanied by another distinction, a set of conditions which separates convergence from parallelism. Similarities in characteristics between organisms can be classified as homologous (coming from a common ancestor) or homoplastic (not due to a similar ancestry) (Powell, 2009). Convergence is often identified with homoplasy and parallelism with homology. An exception to this division occurs when closely related species develop similar features through the same developmental genetic pathways in which case homoplasy is identified with parallelism (Stayton, 2015). Since a common ancestor can ultimately be found for all biota these concepts are conflated in definition. As a result a clear boundary has to be established to distinguish the two and supplementary to this a continuous scale to measure the degree of convergence. Powell (2009) argues that homoplasy is akin to parallelism when a developmental embryonic homologue (usually a certain chemical) is a proximate driver of analogous traits which can be measured by a screening-off analysis. Accordingly this qualitative indicator might prove useful in determining the boundary between the notions of convergence and parallelism.

3. The study of convergence

The father of modern evolutionary biology Charles Darwin correctly inferred and hypothesized many of the principles and theories that still stand today as unrefuted. However, the notion that evolution acts exclusively on a glacial or geological timescale has not stood the test of time. Since the study of evolution was for a long time regarded as a historic endeavor this has intricately molded its scope (Losos, 2007).

It was in the end of the twentieth century the view of evolutionary biology as a historical study was permanently altered. When the force of natural selection is strong enough evolution can take place at a stunning pace (Losos, 2007). Therefore it has become possible to study this process over the course of a human life. This is also a consequence of being able to measure genetic changes more accurately, so minute changes can be enough to track evolutionary phenomena. The paradigm of biological evolution has thus shifted from a historical perspective to a more scientific, experimental one.

The construction of phylogenetic trees based on morphological structures as well as the concept of

parallelism are all remnants from this false persuasion. The concept of parallel evolution might eventually be superseded by the notion of convergence. In the future hopefully accompanied by an apt scale to track this spectral spectacle. The construction of phylogenies has come a long way since the discovery of the double helix by Watson and Crick in 1953. The assimilation of ancestral pathways in these phylogenetic maps can nowadays be performed aided by DNA sequencing techniques and comparative analyses via complex computer algorithms. Phylogenetics has therefore become an accurate tool in finding and comparing convergent patterns.

The main constraint in building accurate phylogenetic trees lies in the assumption that sequential, structural and functional genetic similarity imply the existence of a common descent (Powell, 2009). After all convergent phenotypes are supported by such genetic similarities without the presence of a common ancestor. The evolutionary paleontologist Simon Conway Morris also recognized this problem and posed the question whether we have to trust genetic data to define our phylogenetics or the other way around. Human judgments might further complicate this distinction as extreme cases of convergence could be quickly dismissed as too improbable. This principle in biology is referred to as maximum or cladistic parsimony which implies that trees with the least character states and therefore a minimum amount of homoplasy are to be preferred (Rieppel & Kearney, 2006). Maximum parsimony was derived from the principle of Occam's Razor (the simplest explanation is often the best one) which in science is used as a heuristic strategy since uncomplicated theories are replicated more easily (Kite, 2013). In addition, elucidating the character states attributed to existing and ancestral species can be regarded as an unscientific endeavor (Cunningham et al., 1998). This indicates that even molecular phylogenies should be handled critically. It can even be argued that they are methodologically inconsistent (Luskin, 2010).

Scientists have so far come up with a multitude of strategies to quantify convergent events. Currently phylogenetic and phenotypic comparative data analyses are preferred as analytical tools to investigate convergent evolution. The reproduction of analytical procedures is however a scarce phenomenon throughout convergence studies (Stayton, 2015). Re-using the same method(s) would have a homogenizing effect on the study of convergent evolution. The results from the numerous studies on this subject could then be compared a lot easier and studies with anomalous findings could be tested for falsification. Through continuous experimentation and refutation this unified method could develop to become a more powerful tool for uncovering the true significance of convergence.

The future of convergence studies seems to lie in studies aided by DNA sequencing techniques, the development of ever more adequate statistical tests and perhaps computer-based models. There is nevertheless a limit to how much laboratory experiments or computer-guided simulations for that matter can learn us about convergent evolution. Field experiments have long been conducted although prevalence is often given to lab-oriented studies due a higher degree of control over variables such as a micro-climate and enclosed, identical living environments (Morris, 2003). Studies in the field have several advantages compared to lab experiments. These benefits mainly arise because these studies take place in a natural environment opposed to an artificial one. Studies can therefore also be conducted on a significantly larger scale and the species that can be studied are not limited to those that can be transferred to a lab environment for reasons ranging from a lack of fecundity under laboratory conditions to simply being too large in size.

4. Case studies of Hawaii

4.1) Web structure as proxy of convergent evolution in spiders (Blackledge & Gillespie, 2004)

In some cases phylogenetic analysis can support claims of convergence. An interesting study where such an assertion was validated was conducted on the Hawaiian islands. This was an investigation into the web-building behaviors from an adaptive radiation of the endemic nocturnal orb-weaving spider (genus: Tetragnatha) (Blackledge & Gillespie, 2004). These species of spiders persist all of the main Hawaiian islands in similar habitats but were solely studied on the eastern islands of Hawaii, Maui and Oahu. By analyzing the web-building structures through quantitative measures such as web size, silk density and the number of supporting radii it was demonstrated that remarkably sophisticated behaviors can lead predictable outcomes (Blackledge & Gillespie, 2004).

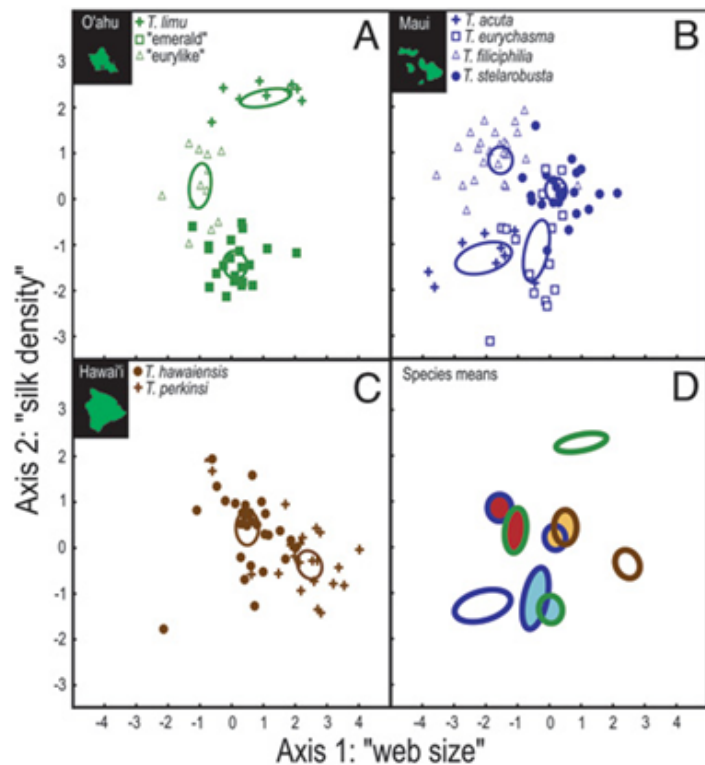


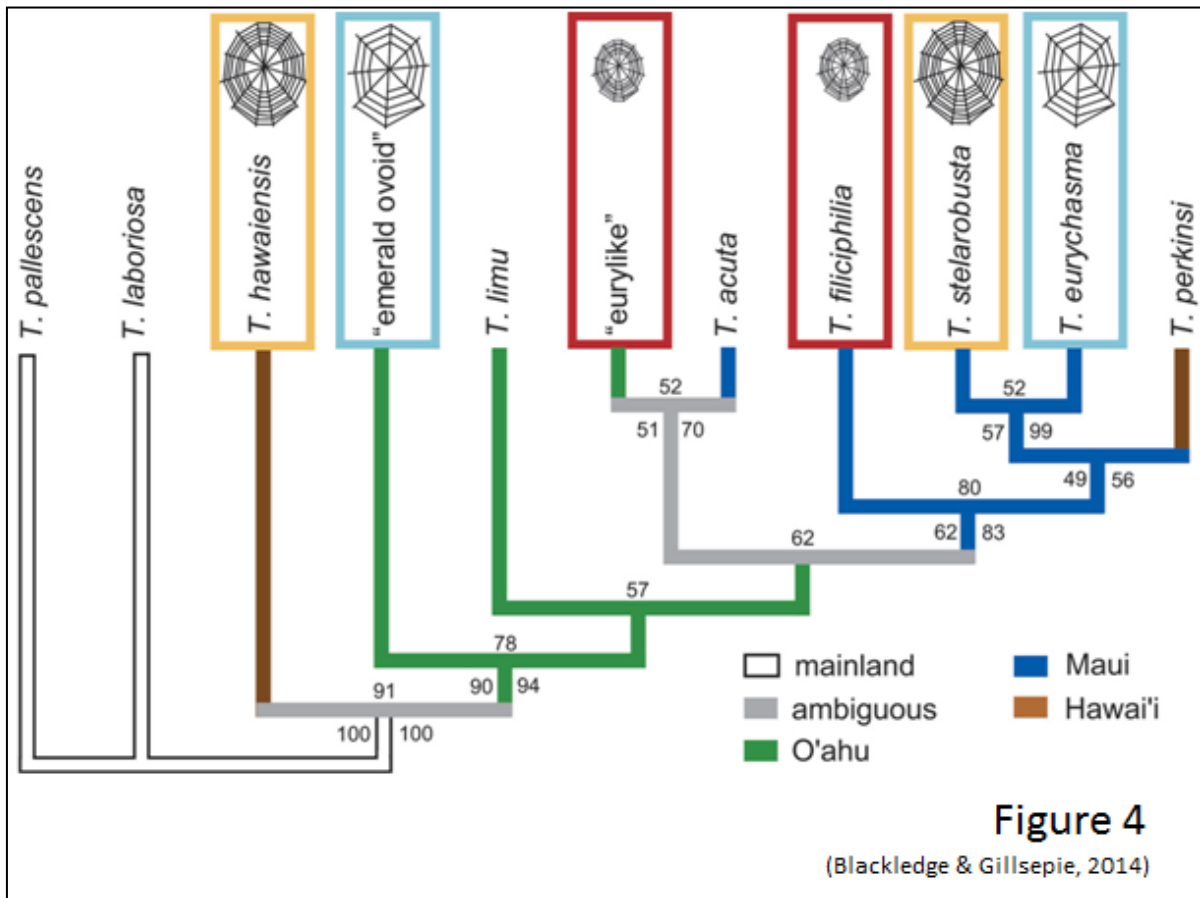
Figure 3
(Blackledge & Gillespie, 2004)

In contrast with continental populations where web structures are relatively homogenous these insular communities of spiders are characterized by the production of multiple specialized web types suited for distinct ecological roles (Blackledge & Gillespie, 2004). This type of specialization is a typical example of a characteristic observed in adaptive radiations (Gillespie, 2005). Two clades are to be discerned on the islands the study took place. The clade that has not lost the ability to capture prey by deploying a web was studied for convergence. In total three pairs of similar web architectural structures on different islands were distinguished and classified as 'ethotypes'. These different types were constructed based on the condition of partial overlap of the 95% confidence intervals from the web means of different species of Tetragnatha based on 'web size' and 'silk density' (Figure 3, D).

The origin of these ethotypes can be explained in two ways. Either the specific ethotypes evolved once and then spread to another island or in situ speciation could have led to a convergence of sympatric species on different islands. The pattern of dispersal is consistent with the genesis of the Hawaiian islands as species from younger islands were derived from older ones. However, this is no evidence for either of these hypotheses.

To reconstruct the historical relationships between all the species three parts of mitochondrial DNA (mtDNA) were analyzed. The computational phylogenetics program PAUP* (Phylogenetic Analysis Using Parsimony* and other methods) was used to create the phylogeny (Figure 4). Phylogenetic trees were created under the condition that all ethotypes were of common descent in combination with the optimality criterion of maximum parsimony. The statistical methods that were used include

Bayesian inference and the maximum-likelihood estimation (MLE). The colors used in this phylogenetic tree correspond to the means represented in Figure 3 (D). The color of the branches from the phylogenetic tree leading up to the different ethotypes is similar to the outer rim of the confidence intervals and the color surrounding these ethotypes corresponds to the color in the

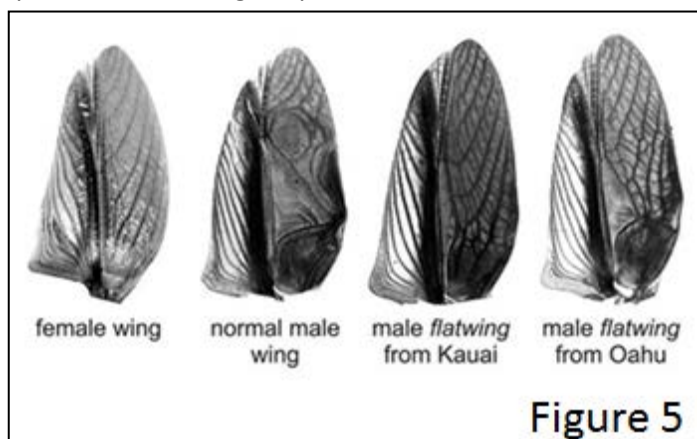


centre (Figure 4).

3.1 4.2) Convergence in the blink of an eye, inaudible crickets (Pascoal et al., 2014)

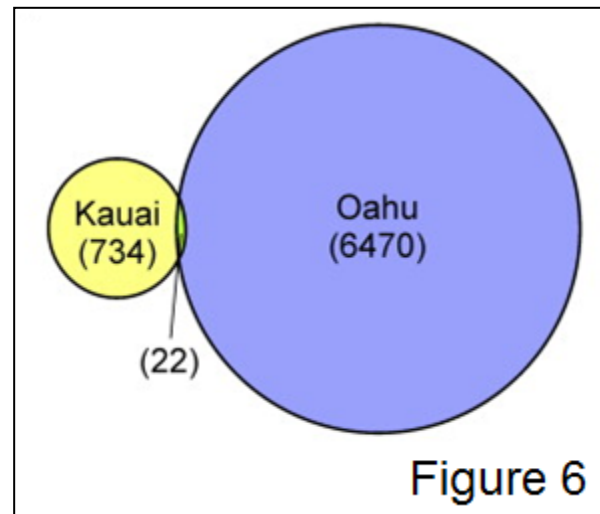
An extraordinary example of convergent evolution that can be observed in real-time are the crickets (*Telegryllus oceanicus*) inhabiting the islands of Hawaii. In 2003 the absence of sound-generating appendices on the forewings of male crickets was first documented on the island of Kauai (Yong, 2014). It is most likely that the predation of this cricket by the sound-oriented fly (*ormia ochracea*) was the primary selective pressure favoring this phenotypic trait (Pascoal et al., 2014). Only two years afterwards, in 2005, this trait started to emerge on the neighboring island of Oahu. Just like in the case of the orb-weaving spiders this lead to the postulation of two hypotheses. One asserting the introgression of flatwing from the Kauai populations into the gene pool of Oahu and the other assuming the independent genesis of this trait on both islands. The

macroscopic differences that can be perceived between the two types of flatwing from both islands by analyzing Figure 5 already hints at the outcome of the morphometric analysis that was performed during this study. The two wing structures are clearly different, they were found to be four times more



distinct from each other than two samples of regular wing venation differed from one another. This was indicated by the eigenvalue, a variable from the morphometric eigenvector analysis.

Flatwing was found to be passed on through single-locus, Mendelian X-linked inheritance on both islands through the processes of crossing and backcrossing and can be compared to this mode of inheritance in humans. Although where humans have an XX/XY mode of sex determination these crickets have an XX/XO variation, and thus the flatwing trait can only be passed on from mother to son in male flatwings. Further genomic analysis was performed through bulk segregant analysis (BSA) due to a lack of a reference genome, assisted by restriction-site associated DNA sequencing (RAD-seq). In this way simple nucleotide polymorphisms (SNPs) could be located in the cricket's genome. SNPs are single alleles at the same locus for two biota of the same species generated by natural variation in DNA (Bhattacharjee, 2013).



There was only a very limited amount of overlap between the sets of linked SNPs. Relatively $(756/22 * 100\% =) 2.9\%$ for Kauai and $(6492/22 * 100\% =) 0.3\%$ of the Oahu markers as represented in the Venn diagram (Figure 6). It is theoretically possible that these 22 SNPs are all associated with a single mutation which due to phenotypic plasticity could be expressed in a different fashion in both environments although this is unlikely considering the bulk of SNPs are unique to each population. Also a former study calculated the fixation index between the populations on Kauai and Oahu to be approximately 0.04 which indicates there is virtually no interbreeding taking place. To close the argument against the introgression hypothesis the mutation related to flatwing was found to originate from dissimilar alleles at the same SNP loci in each population. Both scenario's are illustrated in the timeline (Figure 7) which displays the occurrence of the mutation on the X-chromosome.

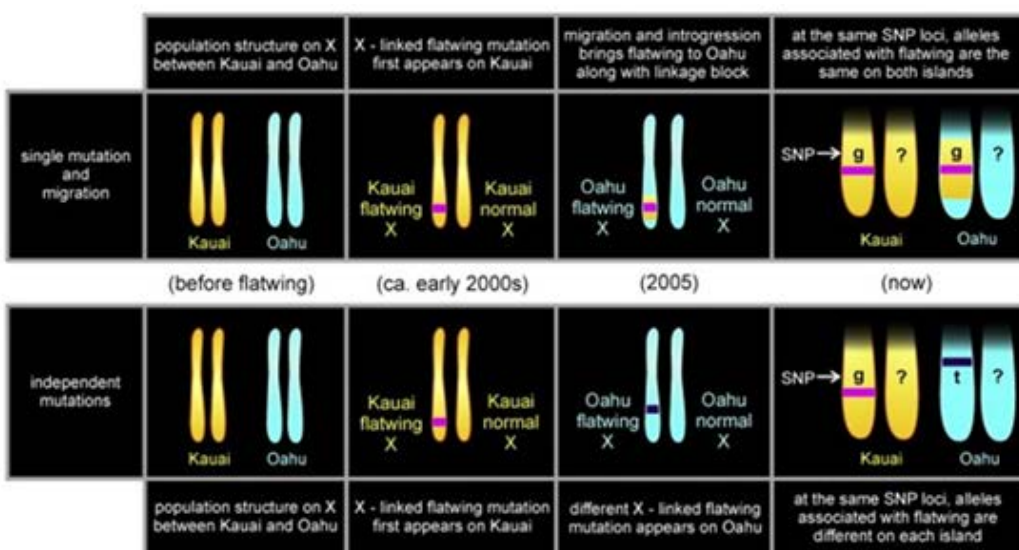


Figure 7

5. The implications of convergence

Disagreement still exists on whether convergence implies determinism or is instead compatible with a more random (contingent) and stochastic process like genetic drift (Stayton, 2015). These two views were inaptly named by Powell (2009) as the Radical Contingency Thesis (RCT) and the Robust Repeatability Thesis (RRT) as the prefix 'Radical' has an undifferentiated connotation while the word 'Robust' carries a more positive load. This in turn could lead to biases. Therefore I will continue to refer to these simply as Contingency Thesis (CT) and Repeatability Thesis (RT), the latter corresponding with a more deterministic view of macroevolution.

The paleontologist Stephen Jay Gould was the first person to propose the CT in evolution. He is best known for his thought experiment which he dubbed 'replaying the tape of life'. This theoretical construct entails the rewinding of time to the moment life first came into existence, after which space-time unfolds again up to the present moment. According to him repeating this process would result in a profoundly different-shaped evolutionary and ecological landscape most of the time. The reasoning behind his expectations was based on two premises. Both presuppositions were based on the fossil fauna from the Burgess Shale, dating from just after the Cambrian explosion. He was convinced these fossil records indicated that practically all body plans in the contemporary era find their origins here. Secondly he assumed that these already developed bodily blueprints, due to their inflexible nature, significantly inhibited the development of new bodily pathways. The rigidity of these body plans would imply that in case these blueprints diverged, a wholly disparate array of animals would have evolved.

The RT on the other hand infers the allegorical existence of nearly optimal solutions and configurations to the problems which the aggregate of biotic and abiotic external selective pressures pose to living organisms. The RT is not necessarily of a hardy determinist variety, hence it does not predict the same spatio-temporal outcome of rerunning the tape of life, rather it implies that over great spans of geological time remarkably similar life forms will evolve (Powell, 2009). Supporters of this theory often stress the role of the environment often demarcated by fixed structural features believed to guide natural selection to produce similar outcomes (Wyard, 2015). Likewise, the ubiquity of convergence is often used as an argument to demonstrate the restrictions of natural variation explained through ostensible shared biases in evolutionary adaptation, called constraints (Losos, 2011).

Although field studies to test the hypothesis of repeatability by observing convergence are mainly centered at archipelago's like Hawaii many laboratory studies have been conducted to explore its premises. Lenski et al. (1995) decided to compare the contribution of the only three variables thought to influence fitness and cell size: adaptation, history and contingency. This was done through two separate experiments with the bacterium *E.coli*. This organism is highly suitable for studies of comparative biology due to its lack of genetic complexity, high propagation rate and asexual reproduction that can be used to create entire populations with the same genotype. To start the experiment twelve replicate populations were first propagated in a nutrient-rich glucose-medium for 2000 generations. Afterwards one genotype of each medium was taken and replicated another three times to found 36 new populations with the same evolutionary history which were again propagated for another 1000 generations in a nutrient-poor maltose-medium.

The conclusion of this experiment coincides with the RT. From the three factors influencing fitness adaptation was found to be most important. The effects of contingency and history were limited. There are however several drawbacks in drawing a parallel from this experiment with *E.coli* to real world (animal) evolution. To start with observations about fitness have not been made at consistent intervals throughout the experiment, only snapshots at the start and end of the

experiment. Also asexual reproducing organisms were used which disproportionately represent the occurrence of point mutations and prohibit recombination (Morris, 2003). Despite these experimental flaws it can be stated that the process of natural selection is no prerequisite for the existence of convergence (Losos, 2011). Nonetheless, this mechanism makes up one of its primary constituents.

6. Discussion and conclusion

Convergence is a concept that cannot be readily defined. It is however of vital importance that the operational definition in any study addressing convergence is pattern-based. It might also be helpful to explain the difficulty to differentiate this pattern from parallelism. Different studies tend to conflate multiple definitions of convergence. They might even lack the explication necessary to establish a clear distinction between the definitions used in their studies and those used in comparative studies. As such a prudent attitude is required in the formation of any operational definition of convergence.

In the past decades the study of evolution has shifted from being a historical endeavor to a scientific one. It can now be studied in real-time opposed to having to look back in time. Convergence studies have for a long time been supported by the construction of phylogenetic trees. Ever since the inception of phylogenetics the arrangement of species through this heuristic, scientific tool has been criticized as inadequate. New developments in DNA-sequencing techniques and statistical analyses have proved valuable in the strengthening of phylogenetics though they are not infallible. Human error has yet to be eliminated. Exact genotypic convergence for example could be overlooked due to having similar DNA sequences. It is of equal importance to propagate the techniques to study convergence beyond their original use. Nonetheless different studies might be incompatible with the application of similar tools so the selection and tailoring of methods to suit a specific study could therefore prove more useful.

Especially because isolated oceanic islands like those of Hawaii are rich in adaptive radiations they prove to be valuable assets for field studies aimed at understanding convergent evolution. Besides the adaptive radiations of spiders and crickets convergence has also been demonstrated in the adaptive radiations of the Hawaiian honeycreeper, caterpillars and many other organisms (Lerner et al., 2011). The many instances of convergence do however not by themselves validate its ubiquity. The construction of null models would be useful to predict how likely it is that convergence has happened a certain amount of times within a specific time period. The relative fullness or emptiness of a theoretic 'phenotypic space' that could be determined by such a model could then be interpreted to infer the limits to evolution (Stayton, 2015).

The implications of convergence are mainly important for establishing how deterministic or contingent the pattern of convergence is. This has fundamental consequences for the way in which evolution is restricted in generating new diversity and thus the possibilities to give rise to stable organisms in ever changing environments. According to most studies the process of convergence implies at least some degree of predictability. However, it will remain a challenge to prove this and probably impossible to determine to what degree this is true. The recognition and interpretation of convergent pattern should be dealt with carefully as the existence of convergence does not necessarily imply that any process is responsible for it.

Conclusion

In this book chapter, the islands of Hawaii were viewed from almost entirely different perspectives.

First, research into the history of Hawaii showed that the Hawaiian archipelago has changed from a sovereign kingdom to being a part of one of the most influential countries in the world, the U.S. The act of the Overthrow in 1898 can be considered as an illegal act from a juridical point of view. Still, the Hawaii became part of the US as a result of a national referendum in 1959. Adding to the deprivation of sovereignty Hawaii also lost parts of its culture. Especially the influence of the Native Hawaiian on the Islands decreased crucially since the missionaries arrived. Nowadays, Hawaii is considered to be a gathering of people from various countries. Only 6% of them are Native Hawaiians. There have always been protests against the heteronomy and social movements have been established. Most of them aim to restore the Native Hawaiian traditions. Still, it remains unclear how much of the Hawaiian culture can be restored. The example of Hawaii shows that islands' culture and population can be easily damaged by countries with greater power and influence. It teaches us that, if we want islands' traditions to be maintained, to be careful with their fragile system.

This research was followed by research that concentrated on the energy aspects of the state of Hawaii. The current energy systems were analyzed and this research also looked into the energy self-sufficiency potential of Hawaii. Recognizing that the climatic conditions on the island in combination with the other favorable conditions that can be used to generate renewable electricity make for a great renewable energy generation potential. Paradoxically, Hawaii's dependency on seaborne petroleum is high and as a result of this the electricity prices are the highest in the entire U.S., up to 3 times the national average.

To combat these issues and enable Hawaii to take full advantage of its vast renewable energy potential, the HCEI was created. Its goal is to create an energy portfolio that consist of 100% electricity generation from renewable energy sources by 2045, combined with an increased energy efficiency of 30% by 2030. In order for Hawaii to achieve these goals it turns to renewable energy sources, being primarily: wind, solar, geothermal, biomass and OTEC. The islands have geographical and geomorphological features that favor the renewable energy generation potential for each of these forms of energy generation. Resulting in a situation where almost each of the individual renewable energy sources mentioned above, are capable of generating enough energy to provide the island state with its 100% renewable electricity goal. However, in order for this potential to be realized, the islands of Hawaii have to invest in infrastructure. With the intermittent nature of the renewable energy sources' output in mind, it is critical to develop an interconnected electrical network as to distribute and coordinate the electricity supply and demand in an efficient manner. Also, there is a need for the storage of electricity, a battery-like system. All in all, an electrically energy self-sufficient Hawaii seems feasible. Whether Hawaii is capable of reaching their goal HCEI goals on time however, is a question only the future can answer.

The next research concentrated on the economic aspects of the Hawaiian archipelago. It was tried to find out if Hawaii is actually dependent on the economic sector of tourism. Starting with a look on the economic sectors and their importance in the past and present. It turns out that the plantation sector was replaced by the tourism sector. Reasons for this replacement are the mechanization of production cycles and the reorientation of workers in consequence. Further research showed the connection of the tourism sector to other economies, namely the ones of the US and Japan. That resulted in a one-sided dependency and every time a crisis hits one of the linked markets Hawaii feels the direct effects. Furthermore, due to its insularity, accessibility is a risk for the islands' economy. The concentration on airplanes is a problem that could be seen after 9/11 when the tourism industry broke down. Alternatively, the cruise industry was looked at as another way to

access the islands in future. However, Hawaii still has a long way to go for that economic branch to become profitable. The example of Hawaii demonstrates that relying on one economic sector is risky. Additionally, overcoming connection problems requires a lot of effort. Especially islands can be disadvantaged in this context.

The last research paper explored the role of Hawaii as a natural laboratory in respect to convergence. Convergent evolution is a central concept in the study of evolutionary biology. There are however several inconsistencies in defining this concept which have to be addressed. The development from the study of evolution in the past decades into a scientific pursuit emphasizes the necessity for a standardized definition of convergence. The same standardization is required for the ubiquitous methods used in convergence studies. The fact that the Hawaiian archipelago functions as a natural laboratory makes it an excellent candidate for field studies on convergent evolution. In addition there are many adaptive radiations on Hawaii of which two case studies are featured in this paper. The study on the orb-weaving spider *Tetragnatha* is significant because it focuses on convergent behavior instead of a convergent phenotype. The case of the cricket *Teleogryllus oceanicus* is a typical example of convergence in the blink of an eye, on an evolutionary scale. To conclude this overview of convergence and the significance of Hawaii for its further examination the possible implications of the limits to the plasticity of this spectacle were put into perspective. This was done by comparing two ends of a spectrum. The one being a deterministic view and the other being a contingent one. Determining to what extent either of these opposing views can be validated will be a challenge. Perhaps a definite answer to this age-old debate will one day be found somewhere far out into the Pacific, on a remote group of islands, by a small group of dedicated nissologists. Only time will tell.

Although there can be no overall lesson learned from this research, there are various specific ones. These findings can help us understand both islands and function as a metaphor for greater, or even smaller problems. The lessons that can be learned from islands can even be applied on a global scale as Earth is after all an island floating in an all-encompassing cosmos. It does not matter if these findings concern the history, the economy, the ecosystem or energy supply. Hawaii is also similar in its problems to other islands around the world. Together these disciplines can help solve problems on a broad range of scales. However, this promise can only be fulfilled through an integrated, interdisciplinary approach. Therefore there is a need to develop an interdisciplinary framework for nissologists to overcome problems on both a local, regional and a global scale. We hope that by writing this book chapter we can at least contribute to the growing body of knowledge of island studies.

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Cold water islands as laboratories and places of innovation

A case study of Iceland and the Aran Islands



Figure 1. Map of northwestern Europe with added pinpoints for Iceland and the Aran Islands.
(Source: University of Texas, 2012. Retrieved on 29 January 2016, from: <http://www.lib.utexas.edu/maps/europe.html>)

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Abstract

As we have seen and discussed through this nissology course; islands are models for our world. The insularity and specific elements of flora, fauna, economy, culture and environment teach us how sustainability is vital to planet Earth. This chapter shows examples in a few of the cold water islands in Europe: Iceland and the Aran Islands near Ireland. We see islands in this chapter as novelty sites: as a laboratory and source of knowledge and inspiration for other parts of the world.

Iceland is famous for its ruinous collapse of the banking sector during the financial crisis in 2008 which affected a large amount of people in several countries.

The deserts of Iceland illustrate that desertification is a complex problem occurring even in cold climates. It is often caused by mismanagement of the land. The identification of islanders with their Iceland is probably key to the solution.

Introduction

Iceland and the Aran Islands are both located on the northern hemisphere. While those islands do not consolidate the common view of islands, they are very interesting areas to study due to their islandness. This is because there are a lot of lessons that can be learned from them. This chapter will demonstrate how Iceland and the Aran islands are both laboratories and places of innovation.

While many believe the success of Icelandic music is related to its landscape and mythical sphere, Baardman argues that it is due to social factors. Scarcity of resources, isolation and remoteness lead to creativity and a dense social network in which the music scene can flourish.

And as one might not expect, 40% of the Iceland geography consists of deserts. Soil degradation, erosion, climate change and land-use are important factors regarding this issue. Kooistra will show the importance of studying this phenomenon on Iceland for further desertification research.

Boven explains in this chapter the Icelandic economy, and the impact of isolation and crisis on creating a self-sufficient economy. De Rijk adds with a study of energy independence on Iceland. Some more innovation lies in history. Van der Kamp researched the impact of the 19th century Great Famine in Ireland on the Aran Islands, and argues that the resilience of the Aran agriculture and the strong sense of community can be effective lessons while facing current and future famine crises in landlocked rural communities in Sub Sahara Africa.

Punching above its weight

Rens Baardman



fig 1. Iceland post-rock band Sigur Rós performing live¹

Introduction

Iceland has a very interesting music scene: famous and internationally acclaimed music artists such as Björk and Sigur Rós come from this islands, while it has only 320.000 inhabitants. This has raised the question – in popular media as well as in scientific writings – on why Iceland is such a good 'breeding ground' for musicians. Is it the inspiring nature? Sure, there are many beautiful geysers, volcanoes, and unspoiled land as far as the eye reaches, but a further investigating indicates this is not the (main) reason for the Iceland success. In this paper, I would like to claim the island-ness of Iceland is of importance in understanding the reasons the Icelandic music scene has become so successful and well-known over the last decades.

The research in this paper is based around my question: what are the island-characteristics that explain the abundance of internationally successful musicians from Iceland? I will start by giving an introduction to the Icelandic music history, we then determine that Iceland has a successful music scene, and I will then try to find the reasons of this success with a particular emphasis on the island-characteristics. This paper is partly based on the on-ground observations and interviews by Nick Prior (2015) and Ilana van den Berg (2010), that give in interesting insight into the music scene. The findings in these papers have been restructured to better include the islands-perspectives.

A short history of Icelandic music

According tot Guðmundsson, it is "the period from the nineteen-fifties to the mid-seventies, when the foundation of Icelandic rock culture was laid" (Guðmundsson, 1993). With building of a military base and airport in Keflavík (near Reykjavík) by the US during de Second World War, an North-American influence could be seen in Iceland during and after WWII and the independence of Iceland in '44. Pop and jazz music was imported and popular Icelandic tunes were composed. Rock gained ground in Iceland also because of the Keflavík military base: in '56 the US

¹ photograph by Alive87: <https://www.flickr.com/photos/alive87/8515786459/>, hosted on Wikimedia Commons: https://commons.wikimedia.org/wiki/File:Sigur_R%C3%B3s_2013.jpg

soldiers based there were asking the Icelandic dance groups to play rock-tunes. This was the beginning of a 'dance-craze', with even some English and other international artists coming over to play in Iceland (Guðmundsson, 1993). Later on – between '70-'75 – there was also an 'English era', showing the new influences from the side of Europe.

There is more or less a common opinion that the short 'punk boom' between '80-'82 was formative for the Icelandic rock music to come and still to date (van den Berg, 2010; Kitchen, 2010). In the music documentary 'Rokk í Reykjavík'² that captures the punk-scene at that time, for example Björk Guðmundsdóttir was portrayed live on stage with her band 'Tappi Tíkarrass'. This is considered to be the first serious music project of Björk, who is now an internationally acclaimed music artist and seen as a 'mentor' in the Icelandic music scene.

The influence of the 'punk-boom' can also be explained by the new way Icelanders were able to use instruments: for long, only a limited amount of musical instruments was available. The Icelanders that had instruments in their possession in that time, tried to imitate the high-tech Western studio-sound, but weren't skilled enough to do so. It was only when the punk arrived and more instruments could be bought, the threshold to start making music was lower and this creative period followed (Wayman et al. 1992, in Kitchen, 2010).

This was only the beginning of the era of successful Icelandic rock, with artists as múm, Björk (also originally with The Sugarcubes), GusGus, Sigur Rós and later on new artists such as Ólafur Arnalds, Asgéir Trausti and Of Monsters and Men. It was also the onset of a flourishing independent, DIY-scene, with many small music labels and record stores, and the launching of online music-services as Gogoyoko.com, Grapewire.com and Tonlist.is, which provide(d) web shops and streaming services for musicians and fans (Kitchen, 2010). This short sketch of the forming of the Icelandic music culture is our starting point to research the reasons behind the success of it.

The success of the Icelandic music scene

First of all, it is required that we determine how and in what aspect the Icelandic music scene is successful. This is of course a hard thing to measure, but according to Van den Berg (2010), "several articles on the Internet and in popular music magazines refer to the Icelandic scene as innovative, disproportionately productive and internationally successful" (p. 17), and

"[a]lthough the Icelandic music industry is small, according to the former Icelandic Minister of Culture, Þorgerður Katrín Gunnarsdóttir quoted in Barret (2008), it has been performing beyond expectations: "The Icelandic domestic market is one of the smallest in Europe but internationally our music industry is punching far above its weight" (para. 6). Numerous institutions, music journalists, and scientists support this statement". (van den Berg, 2010, p. 17)

Another indication is the international popularity of the Icelandic music festivals, with visitors from all over the world coming to Iceland specifically for the summer-festivals (Sigurðardóttir & Young, 2011). And the music industry forms a significant part of the Icelandic economy (Einarsson, 2005). Research on what measures there are to determine the success of music scenes and even on the question what defines a music scene has been abundant (see for example Brown et al., 2000 and Crosley, 2009 for similar research on the success of the Manchester-scene), but for the scope of this paper it is reasonable to state the Icelandic music scene is successful enough that it is interesting to look at the reasons for this success. For now we will see the Iceland music scene as everything music-related contained and/or originating within the boundaries Iceland, but a point could be made that also the (sub)scene in Reykjavík alone is of such importance that it could be viewed and researched as a independent scene itself (see later sections in this paper for a discussion of the relevance of the scene in Reykjavík).

Explanations for international success

Creativity and artistic freedom

One of the things that is often seen as explanatory for the Icelandic success, is the general high levels of creativeness and artistry of the Icelandic population. It is socially accepted and encour-

² by filmmaker Fridrik Thor Fridriksson, premiered in 1982

aged to have the ambition to become an artist – be it a writer³, a visual artist or a musician. Sindri Már Sigfússon, of the popular band Seabear, gives an example of this: “When I was like 9 [or] 10, I told my family and grandparents I was going to be a painter, and they were very happy with that...” (in Hua, 2010). The professional musicians usually have a lot of artistic freedom. Except for the Sena label, the record companies on Iceland are small and independent⁴ (van den Berg, 2010). Most of the musicians do not care so much about commercial success, mainly because it is very hard to earn a living out of a music career on Iceland. As Van den Berg (2010) summarizes the finding of her interviews with musicians and other relevant to the Icelandic scene: “[m]any respondents mentioned the impossibility of making a living out of music in Iceland as a reason for the artistically innovative music” (p. 33). The impossibility to make a decent living out of music has a number of reasons. Amongst others, the musical market is very small and the music industry is not very well organized, as one respondent notes:

“You only have to sell 5000 records to get a gold record. I guess it's pretty similar to the music scene itself, there's very few labels, and they work pretty locally, it's not really big business. Or people with a really good sense of business necessarily. People start doing things more out of ideals than actually making any money from it. It's a bit local and chaotic I would say.” (in Van den Berg, 2010, p. 65)

Besides that, the government support is limited, although recent initiatives such as the Iceland Music Exchange (IMX) have been founded to make it easier for artists to distribute their music and get international attention. Also, the internationally known show-case festival Icelandic Airwaves is partially sponsored by the government (Van den Berg, 2010). The recent economic recession in 2008 also made it harder to get funds or support for events, although this has happened too recently to have had an impact on the international success.



fig 2. Icelandic duo Kiasmos performs live at Kex Hostel as part of Icelandic Airwaves 2014⁵

Another reason that might explain the creativity and musical talents is the good musical education, especially for younger children (van den Berg, 2010). Finally, the general attitude to music seems to be one of enjoyment and music is seen as a social activity, which would decrease the pressure to perform. This could be attributed to – although this attribution is quite controversial, but has seen quite some attention in popular media – the fact that there is not much 'regular' entertainment for younger people, especially in the dark and cold winters (Prior, 2015). This would force people to provide their own form of entertainment and social activity – for which making music is a very suitable option.

'The Icelandic sound'

³ it is said that every Icelander writes at least one book in his life. While this is a major overstatement, around 1 in 10 Icelanders will publish a book during his lifetime, and there is a flourishing literature scene around Reykjavík – see <http://www.bbc.com/news/magazine-24399599>

⁴ this independent refers to the labels not being part of major music corporations, like Universal or Sony BMG - bands from independent labels are referred to as 'indie' bands, although in the last few years, 'indie' has also become a broader term, used as an indication of a certain musical sound.

⁵ photograph by Nicky Digital: <http://nickydigital.com/2014/11/airwaves-d2/iceland-2014-iceland-airwaves-music-festival-141/>

Music critics and journalists often like to attribute the qualities of 'the Icelandic sound' to Icelandic bands, such as "raw, experimental, melancholic and original" (van den Berg, 2010, p. 47). Icelandic musicians themselves, however, do not think there is 'one Icelandic sound', although the aforementioned characteristics do apply relatively often. There are, however, more and better explanations for the fact Icelandic music is appreciated internationally. Icelandic musicians do acknowledge their wide variety of slightly left-field sounds: they explain this by the fact that musicians try to have an original sound relative to the other Icelandic musicians, because everyone knows each other. This makes copying each others music frowned upon, because everyone will know you have copied someone else's style. (Van den Berg, 2010) This is one of the results of the tightly-knit musical community (mainly) in Reykjavík, which 7 out of 10 respondents from Van den Berg's research think plays a role in the international success (Van den Berg, 2010). Commonly noted too, is that the new found musical identity is an answer to this search for identity, starting after Iceland became independent in '44. As Björk herself notes in the documentary *Screaming Masterpiece*⁶: "[m]y theory is that when Iceland got independent in 1944. It still took two generations to develop a real confidence."⁷ – this development also coincides with the punk-boom. The original sound of the Icelandic musicians could well be an outcome of this. Finally, the remarkable history of music in Iceland could have contributed to the remarkable sound: it was only very recently that there was access to musical instruments. As conductor and composer Daníel Bjarnason stated: "[t]here was no playing of instruments to speak of in Iceland, until the last century, and our musical history is very short. In some ways, I think this is a good thing, because we are not weighed down by it, and we don't feel that we need to continue any tradition of a certain music. So, there is freedom!" (in Hua, 2010)

Work-ethos: 'Icelandic spirit' and 'island syndrome'

Even musically talented, creative and original people won't get international acclaim if they don't work hard. Luckily, the good work-ethos of the Icelanders in general and the musicians in particular has contributed to their international success. Sindri Már Sigfússon, of Seabear: "I think it's more of some sort of 'Icelandic spirit' that pushes a lot of bands – a 'work hard and do your best' kind of feeling" (in Hua, 2010). This could be explained by Iceland's history: until about WWII, Iceland was mainly dependent on agriculture and fishing (Guðmundsson, 1993) and was quite poor, because of the scarce natural resources, and the limited export- and import-facilities due to the remoteness and isolation. A good work-ethos was needed to be able to make the best out of it (Van den Berg, 2010). Nowadays, there is still a willingness under musicians to work hard. This may come because of the 'Icelandic minority complex':

"something that has to do with living on a remote island and the anxiety of not being noticed. One respondent refers to this inferiority complex as 'the island syndrome'. He believes that because of this syndrome, Icelandic musicians are eager to get themselves out there and looking for international recognition. This urge for competition or maybe even fear to be overlooked combined with a great belief in your own competence [...] results in the willingness to work hard to achieve this recognition." (Van den Berg, 2010, p. 33)

The Icelandic music scene also has a remarkable Do It Yourself (DIY) mentality, influenced by the days of the punk-boom (Sigurðardóttir, 2004), combined by the historical need to produce everything yourself – on an isolated island, there is no one from the outside to do it for you. The DIY-mentality can also be a necessity, because record labels frequently go bankrupt because of the small market. This reinforces the need to organize things yourself.

The Reykjavík-scene

The population in Iceland is concentrated in Reykjavík, with around 40% of the total population of Iceland – 120.000 out of 320.000 people – living there⁸. The musicians are even more concentrated in Reykjavík – almost 80% of the musicians, it is estimated (Van den Berg, 2010). The local music scene is vibrant: the connections between musicians are short, and the network is tight-knit (Prior, 2015). This – according to many of the musicians, and as is the central thesis of Nick Prior's article – forms the basis of the success: the musicians play in a lot of different bands

⁶ by Ari Alexander Ergis Magnússon, premiered in 2005

⁷ this quote is also included in the trailer of *Screaming Masterpiece*: <https://www.youtube.com/watch?v=m4Wc4Xcx41g> (around 1:30); my translation is based on the subtitles there

⁸ source: <http://statice.is/statistics/population>

simultaneously, because they happen to know the other musicians; a lot of concerts are being organized, because it is easy for the musicians to arrange them because of the short and informal connections with venue-owners. It is sometimes described as 'one big family' (Van den Berg, 2010).

An international gaze

On top of that, musicians are relatively internationally oriented: a lot of the musicians already have an international network, because they went abroad for work or study. Also, musicians that want to have a career in music have to think internationally, because the Icelandic market is too small. Some musicians have stated that they feel 'closed in', so they go abroad. The earlier mentioned 'island syndrome' also plays a part in the eagerness to go search an international audience (Van den Berg, 2010).

The image of Iceland

The last reason I would like to touch upon, is the image of Iceland. As Kitchen (2010) words it: "It is a nation at the fringe of human habitation and thus, for many, it remains an unknown, exotic space, defined in part by the mythologies and assumptions of others" (p. 90)

This also has to do with the 'nature' aspect of the image of Iceland: often, the success of Icelandic music is attributed to the inspiring nature. Iceland is then described as 'barren', 'desolate' and 'cold', or 'mysterious', 'mythical' and the geysers and volcanoes are mentioned. But, as Nick Prior (2015) cites on of his interviewees: "It's A Social Thing, Not a Nature Thing". The image of Iceland mainly helps the music scene get more famous abroad. The nature and national image of Iceland certainly affect the musicians (Dibben, 2009), but it from interviews with musicians, they do not state the usual 'inspiration from nature' as a forming factor for themselves.

The difference between the international image of Iceland and the image the Icelanders themselves has, is something we have also seen in the lecture by Henk van der Liet: image of islands from the outside are constructed (Liet, van der, 2015). There is even a parallel between the image of Iceland in the medieval time and now. As Ísleifsson mentions about the medieval age: "the discourse on these islands was part of the international power dynamics of the time. The question of primitive versus civilized was particularly important" (Ísleifsson, 2011, p. 62) – in the same way, Iceland is now viewed as 'original' and 'authentic', possibly as a way to position it against the 'overproduced' and 'commercial' (other) Western music. Thus, the discourse on Iceland is now part of international 'music business dynamics'.

Conclusion

Focusing on the islandness, we can see there are a lot of islands-characteristics that are a determining factor in the success of the Icelandic music scene:

- the scarcity of resources has impact in different ways, with different 'resources'. Because the music industry is small, the labels are independent and artists have musical freedom which makes way for the authentic 'Icelandic sound'. The earlier scarcity of instruments has stimulated inventiveness and originality. The number of potential listeners in their own land is low, so Icelandic musicians need to have an international gaze to make a career. Because there are little people living in Iceland, the social networks are dense and tight-knit, and 'everyone knows each other', which makes forming bands and arranging concerts easy. Also, because in earlier days it has been hard to produce enough food with agriculture, the work-ethos is very good and people – especially musicians – are willing to work hard.
- the isolation has an effect on the above reasons, and makes an independent sound possible, because musical styles from other countries didn't have such a big impact on the Icelandic styles
- because of the remoteness, it has been hard to import from other countries (although it has been easier in the last decade, imported goods are still relatively expensive), so there has been a flourishing Do It Yourself attitude, which has sparked creativity
- general island-characteristics, such as the image the rest of the world has of Iceland which has fueled international interest in the Icelandic music, and the urge to express and show yourself and your capabilities due to the 'Island Syndrome', top this all off, to create a fertile set of reasons for the creativity and success of the Icelandic music scene.

Inspired by Godfrey Baldacchino (2013), we can say Iceland is a place of (musical) innovation, a 'site of novelty'. Not so much influenced by the mainstream, it dares to be different, to innovate and is therefore authentic and attractive to external 'viewers'. This might be the most concise summary of why Iceland is the place of origin of so many creative and acclaimed musicians. And it is therefore my claim that the musical success of Iceland cannot be interpreted without taking into account the island-characteristics.

The deserts of Iceland

Suzanne Kooistra

Introduction

Currently the global human population is rapidly expanding (Rijsdijk, 2015). This leads to increasing consumption rates which result in exponential exploitation rates of the earth's natural resources. Soil is such a natural resource and it is finite and essentially non-renewable (Lal, 2009). This is due to the slow growth rate of soil; it generally takes 500 years to build 25 mm of soil (Montgomery, 2007).

If soil is misused and mismanaged this can lead to desertification (Lal, 2009). According to the World Health Organization (2015) desertification is a form of land degradation by which fertile soil becomes desert. The WHO (2015) defines several potential impacts on health that can be caused by desertification. Those impacts can be divided in two sorts; an impact which has many indirect responses and a direct impact. Firstly, desertification can lead to a reduction in crop production as ground-water levels to fall beyond the reach of plant roots. This results in a higher threat of malnutrition which can evoke several responses. The lack of existential means can lead to people migrating to other areas (Westling, 1994). Those refugees put an extra strain on the carrying capacity of their new home countries which can thus induce conflicts (Nnoli, 1990). The WHO (2015) also states that this migration can then result in the spread of infectious diseases. Secondly, another potential direct impact described by the WHO (2015) is that desertification can contribute to respiratory diseases caused by atmospheric dust originating from wind erosion.

Those threats indicate that desertification is an undesired phenomenon. However, the exact causes and possible solutions regarding desertification are very complex (Schwilch et al., 2007). Warm temperatures are for example not necessarily the main cause of desertification. This is because it can also occur in Arctic climates (Lal, 2009). Studying an arctic island like Iceland can contribute significantly to gaining a better understanding of desertification processes in general (Arnalds et al., 2001).

One of reasons that Iceland is a good study area for desertification processes is because it is an island. An island provides a manageable study area and is a bounded system (Deschenes & Chertow, 2004). For this particular case it implies that the soil is less complicated as soil-formation is a result of a complex interplay between parent material, climate, organisms, relief and time (Jenny, 1941). This implies for example that soil material cannot travel as far as compared to continental areas. Additionally, there is a lower amount of biodiversity on Iceland compared to common mainland. Because Iceland is not such a substantial island the climate is relatively homogenous which is also useful considering the study of soils.

Because Iceland provides this valuable research area this paper will examine desertification on Iceland. For this it is required to first discuss the definition of desertification. After the examination of the concept desertification this paper will go into desertification specifically on Iceland. It will analyse what the causes are and how these relate to Iceland's biophysical environment. After this it will be discussed how Iceland has tried to solve its desertification problems.

Concept of desertification

The definition of a concept is of significant importance as to how management policies considering that concept that are implied. This entails that if the definition of a concept is broadened it can lead to different management approaches. If desertification will be considered as a phenomenon that can also occur in humid areas this will imply that a considerable number of other areas will be regarded as affected by desertification as well. This might result in land use management changes to tackle this desertification. This section will provide some detailed information on the development of the concept desertification and how Iceland can help to broaden the current perspective.

Desertification is defined by the United Nations Environment Programme as land degradation in arid, semi-arid, and dry sub-humid areas resulting mainly from adverse human impact (Dregne & Chou, 1992). This definition has been broadened by the UNCCD in 1994 by entailing climate fluctuations; it has currently been defined as 'land degradation in arid, semi-arid and dry sub-

humid areas resulting from various factors, including climatic fluctuations and human activities' According to Baartman et al. (2007) this newer definition became the most widely used. However various sources indicate that this is a vague definition (Islandic Institute of Natural History, 2001; Arnalds, 2000). The vagueness is mainly due to the indefinite meaning of the word 'desert'(Islandic Institute of Natural History, 2001; Arnalds, 2000).

Perhaps the definition stated in the introduction by the WHO would be better; desertification is a form of land degradation by which fertile soil becomes desert. This definition does not literally entail climatic conditions. Only the extra definition of the term 'desert' is then required. Arnalds (2000) would plea for a definition of desert as a barren land; desertification would then be defined as a process occurring everywhere where there is severe soil degradation. This definition would me more justifiable according to Arnalds (2000) because it would prevent other areas that are affected by severe land-degradation from being excluded.

Iceland is important as an illustration for this plea for a broader perspective. This is because the environment demonstrates that loss of soil water storage capacity can be a serious limitation to ecosystem functioning not only in dry climates but in humid climates as well (Arnalds, 2000).

To conclude, in this paper desertification will be defined as form of land degradation by which fertile soil becomes desert. The concept soil degradation will be considered as a synonym of land degradation as both terms are used in the literature to describe the same phenomenon. The definition of those concepts entails a decline in the actual or potential productivity of a soil due to natural or anthropogenic factors (Lal, 1993).

Causes of desertification on Iceland

Iceland has the largest volcanoclastic sandy deserts in the world (Arnalds,2008). About 42% of the land of Iceland can be classified as desert land (Arnalds, 2008). The case of desertification on Iceland is an important illustration for different possible causes of desertification. It demonstrates for instance that not only human and drought activities are of importance considering desertification rates, but also natural factors such as soil types and climatic conditions (Arnalds, 2000). This section will elaborate on the causes of desertification on Iceland.

Because desertification is a form of soil degradation it is useful to first have a general overview of soil degradation. Figure one depicts the processes, factors and causes of soil degradation that could be relevant anywhere (Lal,1997). According to Lal (1997) the processes are the mechanisms that set in motion the degradative trends within the soil. Which kind of degradative processes take place in a certain area is determined by the biophysical environment; those are the factors. The rate of soil degradation is determined by the causes (Lal,1997). The next paragraphs will discuss the most important aspects of the biophysical environment of Iceland and connect these to the causes and processes.

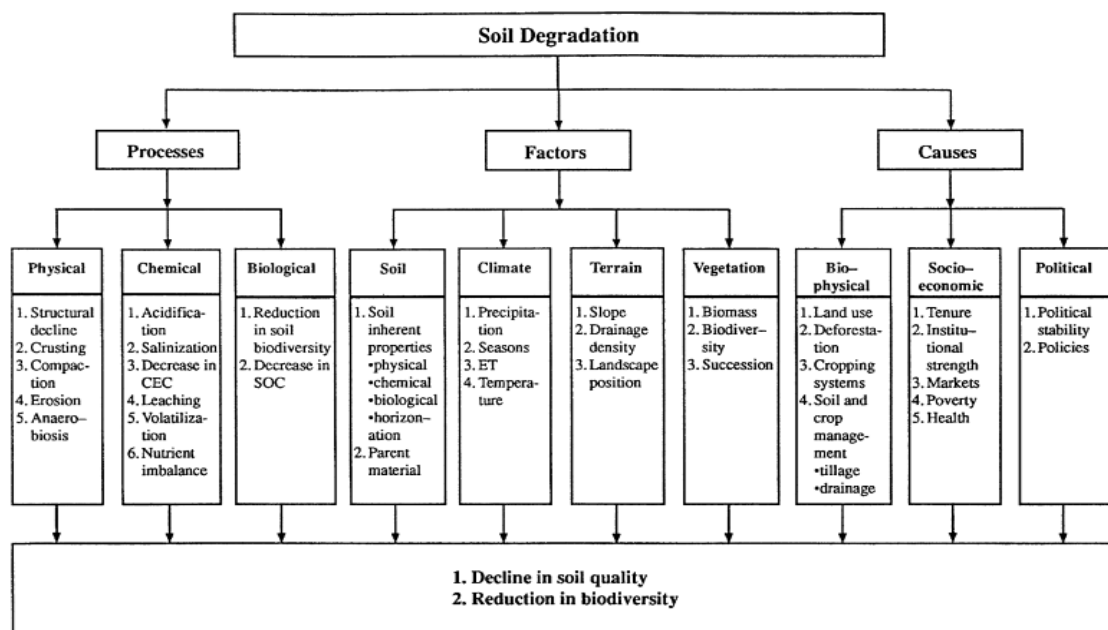


Figure 1: Soil degradation and processes, factors and causes (Lal, 1997, p.998). The factors determine the processes that can take place in a certain environment. The processes set the degradative trends in motion. The causes determine the rate of soil degradation.

Considering the soils in Iceland it is important to notice that Iceland has been formed on a hotspot. This implies that volcanism is a very common feature of the landscape; about 90% of Iceland consists of volcanic rocks (Arnalds, Hallmark, & Wilding, 1995). The kind of soils that are typically formed on volcanic deposits are called andosols. This is why most of the soils on Iceland are andosols (Arnalds, 2008). Andosols are especially vulnerable to erosion as they lack a protection layer from silicate clay minerals (Arnalds et al., 2001). Those silicate clays would otherwise protect the top layer of the soil from wind erosion because the silicate clay minerals are attracted to each other.

It is important to notice that the Andosols that occur in the desert areas in Iceland are also called Vitrisols (vitric soils of the desert) (Arnalds,2008). It is the World Reference Base for Soil Resources (2006) that classifies those soils as Andosols.

Another main soil type occurring in the deserts of Iceland are Leptosols (Arnalds,2008). Leptosols are generally defined as having soil layer which is not thicker than 25 centimetres. This makes it unsurprising that they are common among the Icelandic deserts as it is difficult for vegetation to grow un such a thin soil. A barer soil also entails a soil that is more prone to erosion.

Subsequently, the vulnerability of the Icelandic soils to erosion determines that erosion is a process occurring extensively. Additionally, the terrain of Iceland contributes to soil erosion. It is one of the most severe environmental problems that the country faces (Icelandic institute of natural history, 2001). Table 1 depicts the erosion grade per square area of land. The percentage this area is of the total land cover is told by the third column.

Soil erosion in Iceland.		
Erosion grade	km ²	%
No erosion	4,148	4
Little erosion	7,466	7,3
Slight erosion	26,698	26
Considerable erosion	23,106	22,5
Severe erosion	11,322	11
Extremely severe erosion	6,375	6,2
Mountains	9,794	9,5
Glaciers	11,361	11,1
Rivers and lakes	1,436	1,4
No data	1,015	1
Total	102,721	100

Table 1 (Icelandic institute of natural history, 2001, p.6).

Figure two depicts an erosion escarpment called 'rofabard' which is common among andosols (Thorsonn, 2011). According to Arnalds (1999) it is those extensive rofabard areas that are almost totally desertified. The picture demonstrates that the entire soil profile has gone. Figure three depicts the kinds of erosion processes that generally lead to the formation of rofabords. This figure is also a good illustration how the common erosion processes occurring in Iceland work.

Trampling by animals is a form of erosion because animal feet on the soil cause the soil particles too loosen. This kind of erosion is often caused by sheep that are trying to seek shelter at the rofabords (Arnalds, 2008). Due to wind erosion more material is blown away and this causes the escarpments to become deeper. If the escarpment becomes too deep this will cause the slump to fall off. Water erosion from rainfall causes sand particles to move and this way the soil is loosened as well. Other kinds of water erosion occurring at a rofabard are sheet and rill erosion. The freeze-thaw erosion is caused by the climate of Iceland which will be discussed later.



Figure 2: A 'rofabard' escarpment of 4 m thick (Thorsonn, 2011)

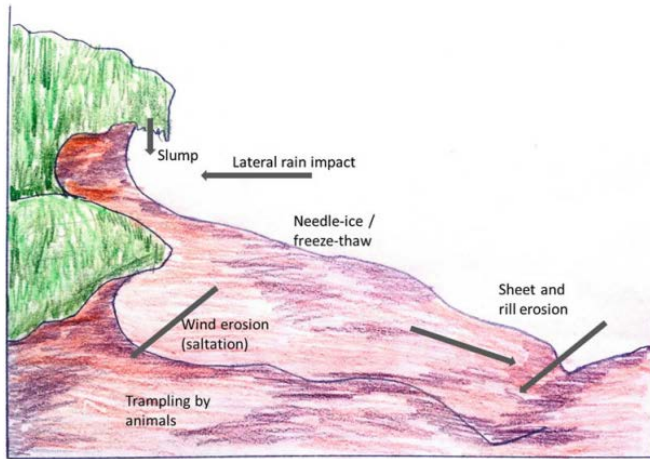


Figure 3: The erosion processes leading to a 'rofabard' (Arnalds, 2008, p.163).

Not only the rofabards but all the soils of Iceland are affected by aeolian activity (Arnalds,2008). This is because of wind-erosion which entails that dust is redistributed. This kind of erosion can cause desertification to spread. So called 'Advancing Sand Fronts' consist of sand from a source of loose sandy sediments which is moved to other areas that are covered by vegetation (Arnalds,2008). The sand often consists of basaltic volcanic glass (Arnalds,2010). The vegetation on which it is deposited is destroyed and eventually becomes desert as well. If the source of the Aeolian materials is constant the advancing sand front continues to expand (Arnalds,2008). Possible sources of the dust are areas that are already desertified and plumes (Arnalds,2010). According to Arnalds (2008) the advancement of the sand front can stop if either the source runs out or if the sand reaches a physical barrier like a hill or a river.

Contrary to most countries, these expanding deserts in Iceland are not caused by drought. In general, the amount of precipitation is abundant. The temperatures are also mild; the mean annual temperature is between the 4 and -4 °C (Arnalds,2008). Because of this relatively cold climate chemical weathering processes on Iceland are less important than the physical processes. In the highlands where it is somewhat colder the soil is influenced by permafrost. However, not all soils are affected by permafrost as it is not common among the whole island. Arnalds (2008) considers the presence of the warm Gulf-Stream to be the cause of this.

However, Arnalds (2008) states that the impacts of frost are evident everywhere. Frost action causes soil erosion because water expands as it freezes. There is an alternation of freezing and thawing of the water located in the pores and cracks of the soil. Because of this alternation the openings in the soil increase over time and consequently the soil becomes less stable.

Landslide susceptibility is also increase due to the cold climate. As a soil becomes saturated due to melting snow this can increase the formation of slip planes (Arnalds, 2008).

In Iceland mismanagement of the land is one of the most significant causes of the desertification (Lal, 2009). One way by which the land is mismanaged is by over-grazing (Islandic Institute of Natural History, 2001). When an area of land is over-grazed this implies that the vegetation is unable to recover even if the animals have moved to other areas. The vegetation of Iceland is especially vulnerable to over-grazing because it has evolved in the absence of large herbivores (Runólfsson, 1987). Due to the isolation of the island large herbivores were not able to reach it without human influence. This implies that the isolation of Iceland has indirectly contributed to an increased vulnerability of the soil to erosion.

Another important aspect of unsustainable land-use on Iceland is the deforestation that has taken place. Before humans settled on Iceland about 30 percent of the country had been covered by woodland (Loftsson, 1993). Lawson et al. (2009) state it is likely that more than 95 percent of this woodland cover in Iceland has been removed in the period between first human settlement and the 20th century. The consequences of the deforestation are also visible in the landscape currently. Figure 4 depicts a totally eroded surface which had been covered by birch forests about hundred years ago (Arnalds, 2008).

Concluding this section, it can be stated desertification is a complex problem to which a lot of influences are relevant. The specific terrain, climate, vegetation and soil of Iceland contribute to

a landscape that is very vulnerable to erosion processes. Mismanagement of the land significantly increases the erosional processes.



Figure 4: A former birch forest (Arnalds, 2008, p.33)

Iceland's Solutions to Desertification

It is important that the current desertification problems on Iceland get solved because the situation is unsustainable. If the fertility of the soil is not regenerated the deserts will continue to expand due to the advancing sand fronts. This can have a major influence on the agricultural productivity. Fortunately, Iceland has already taken some measures to control its problems. This chapter will elaborate on how people have tried to solve the problems and what the prospects are.

In 1907 an Icelandic government agency established the Iceland Soil Conservation Service to tackle desertification (Arnalds et al., 2001). Since the establishment of this service a lot of successful projects on revegetation and ecosystem restoration have been conducted (Arnalds, 2008). The government is for example providing financial assistance to encourage more conservative land-use (Islandic Institute of Natural History, 2001). Snorrason (2010) also states that there is a decrease in grazing pressure from domestic animals. In the foreground of figure five restoration efforts are depicted (Arnalds, 2008).

Arnalds (2008) states that full restoration is possible with time if protection from grazing is continued and also extra nitrogen inputs are applied. These nitrogen inputs can be accomplished in two ways according to Arnalds (2008); through direct applications or through biological activity. The latter implies that Iceland is moving in the right direction. According to Arnalds et al. (2001) it is even the case that "Land reclamation' and 'forestry' are words that now resound in the soul of the Icelander". This may have to do with the fact that Iceland is an island; according to Pitt (1980) islanders identify strongly with their island. Another aspect as to why measures taken by the Icelandic government seem to work is that Iceland is very scarcely populated. This makes it less complicated to implement measures and it increases social control.

To conclude, Iceland seems to be on a positive track considering the measures taken by the government to combat desertification. The outcomes of the measures seem positive which might be due to the island sociology of Iceland.



Figure 5 (Arnalds, 2008, p.20)

Conclusion

Desertification is an undesired phenomenon which poses several threats to different human populations on the world. Iceland is a good research area to study this phenomenon as an island is a bounded system and provides a manageable study area.

The definition of desertification is not clear-cut. The case of desertification on Iceland pleads for a broader perspective on the concept. The definition has to include areas with cold climates as well as arid climates. This is why this paper used the definition formulated by the WHO. This definition entails that desertification is a form of land degradation by which fertile soil becomes desert.

The analysis of the desertification on Iceland demonstrates that it is a complex problem to which a lot of influences are relevant. The specific terrain, climate, vegetation and soil of Iceland contribute to a landscape that is very vulnerable to erosion processes. However, the most important cause of the desertification in Iceland is the mismanagement of the land. Over-grazing and deforestation have significantly decreased the resilience of the Icelandic soils. Those two unsustainable land-uses are the most important causes for the desertification in Iceland.

However, solving desertification on Iceland is possible. To accomplish this it is required to apply sustainable land-use management. This is done by afforestation and preventing over-grazing.

The specific sociological features of Iceland may have contributed to why the country is on this positive track. From this it can be learned that how people identify with their land can contribute to sustainable land management.

Resilience of the Icelandic economy

Bernou Boven

Introduction

Iceland is a country located between the North Atlantic and the Arctic Oceans. With a population of 329,100 and an area of 103,000 km² (Statistics Iceland, n.d.) it is Europe's least densely populated country and the second largest island – only Great Britain is larger (The Commonwealth, n.d.). The country is located on the Mid-Atlantic Ridge and just south of the Arctic Circle.

Due to its remote location, Iceland is mainly self-sufficient. The country obtains all of its electricity and heat from renewable resources. 35% of which is generated through geothermal power (Scientific American, 2008) and is still increasing significantly (Orkustofnun, n.d.). The remaining 70% is provided via hydropower (Scientific American, 2008).

Iceland used to have significant import limitations, relying mostly on its own food production. This was caused by the policy the Icelandic government had put into order to promote local produce, but its remote location was a factor as well. About 50 years ago the Icelandic government has been reducing these import limitations. Icelanders started consuming more diverse foods, relying on imported goods. This shift did not change the importance of the food production industry for the economy (Johannsson, 2011).

For such a remote island it is important to have an adequate amount of food production available for its own population. Events such as natural disasters (e.g. volcano eruptions) or economical problems (e.g. financial crises) can severely reduce the amount of goods that can be imported. Overreliance on these imported goods could potentially lead to food shortages (Johannsson, 2011).

The Icelandic economy was upcoming and booming at the beginning of the twenty-first century (Strand & Hauksdottir, 2014; translated by Boven) and was seen as proof that small states could adopt the neo-liberal system (Thorhallsson & Kattel, 2013).

In 2008 a financial crisis hit Iceland when its three major banks collapsed, causing the unemployment rates to rise (Statistics Iceland, n.d.; Asgeirsdottir *et al.*, 2014), as did the inflation and interest rates (Statistics Iceland, n.d.). Import came to an almost complete stop since the króna lost almost half of its value (Asgeirsdottir *et al.*, 2014). Economical changes were introduced and since 2010 the Icelandic economy has known growth again (Ólafsson & Kristjánsson, 2012).

As mentioned before, Iceland is located far from other countries, but has a strong economy. This economy relies on production in Iceland itself, but also for a part on imported goods. The aim of this paper is to answer the following question: To what extent can the Icelandic economy be considered isolated? To answer this an analysis is made of the recent history of the economic situation. The importance of the answer to this question is to find out whether or not the economic policies conducted since the 1990s have influenced the 'islandness' of Iceland.

Analysis of the Icelandic Economy

Growth 1990 - 2005

Iceland conducted comprehensive free market reforms in the 1990s. This led to rapid economic growth and resulted in one of the highest levels of economic freedom in the world. By doing this Iceland went in a different direction than most other Nordic and Western European countries (Thorhallsson & Kattel, 2012).

The Icelandic financial sector was rapidly expanding at the beginning of this millennium. Iceland had one of the largest banking systems in the world when comparing the country's Gross Domestic Product (GDP) to the assets of Iceland's banks (Asgeirsdottir *et al.*, 2014). This growth was seen as a demonstration of how a small country can succeed in adopting the neo-liberal system (Thorhallsson & Kattel, 2012). About 10% of the Icelandic GDP came from the financial sector (Statistics Iceland, 2011).

One of those reforms was the transition from a steady to floating currency in 2001 (Kallestrup, 2008). This means that the exchange rate is not fixed to another currency, but instead is influenced by economic changes. Aiming to increase the international capital influx (As-

geirsdottir *et al.*, 2016). This did indeed contribute to an increased GDP with an annual growth of near 6% in the four years preceding the crisis (World Bank, 2014).

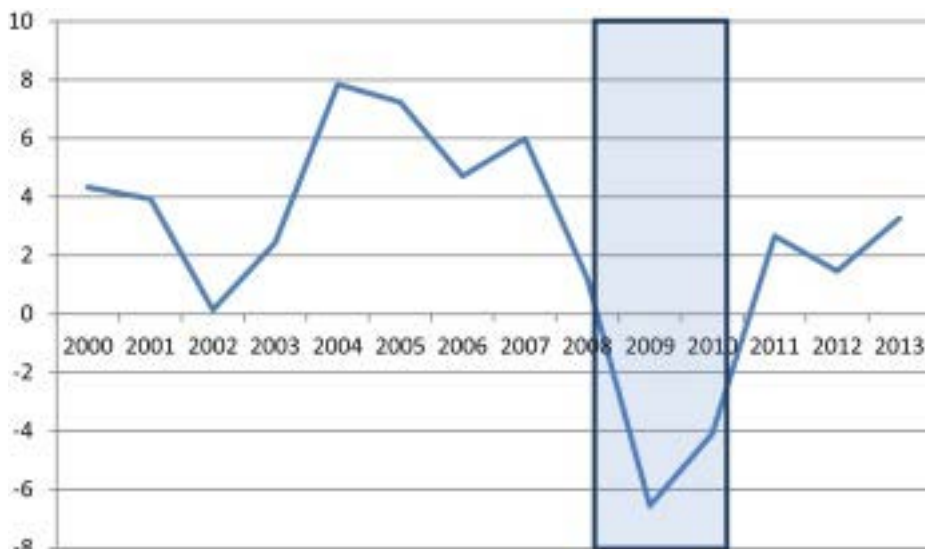


Figure 1: Annual Gross Domestic Product (GDP) growth of Iceland (Agirsdottir *et al.*, 2016).

Economic crisis 2008 – 2010

Iceland was one of the first European country to suffer from the 2008 financial crisis. The crisis in Iceland was mainly caused by overvaluation, a large debt and a large influx of foreign currencies. This, combined with distrust in the market due to the American mortgage crisis, caused the banking sector to collapse (Strand & Hauksdottir, 2014; translated by Boven). The financial turmoil caused a governmental crisis as well as strong social unrest (Thorhallsson & Kattel, 2012).

Iceland was hit harder than several (southern) European countries, with a negative GDP-growth rate of -6,5% in 2009 (World Bank, 2014).

The financial crisis affected the unemployment rate tremendously, rising from only 2.3% in 2008 to over 9% in 2009 (Statistics Iceland, n.d.; Asgeirsdottir *et al.*, 2014).

A large part of the population lost their savings during the crisis and most got indebted (Asgeirsdottir *et al.*, 2014). The interest rates were prohibitive (Statistics Iceland, n.d.) and this caused people to take out loans in other currencies (Asgeirsdottir *et al.*, 2014).

Remarkable for this crisis were more sophisticated financial instruments such as international interconnectedness in the financial market (Claessens *et al.*, 2010) and unique to this crisis, which was the largest and farthest spread globally since the Great Depression (Asgeirsdottir *et al.*, 2016).

Aftermath of crisis

After the Icelandic currency, the króna, lost about half of its value, inflation increased rapidly (Asgeirsdottir *et al.*, 2014) and structural economic changes were conducted. Domestic goods and export became of greater importance (Ólafsson & Kristjánsson, 2012).

An indirect consequence of the crisis can be seen in the suicide rate in Iceland. After decreasing steadily since the last crisis, the suicide rate in Iceland increased rapidly after the 2008 financial crisis (Strand & Hauksdottir, 2014; translated by Boven).

Fortunately, the recession and economic difficulties Iceland has had to face at the end of the first decade of the twenty-first century have had some positive influences as well. These were a reduction in air pollution and increase in social cohesion (Asgeirsdottir *et al.*, 2014), among others.

These consequences of the economic crisis are unique to Iceland. Due to the economical difficulties the country had trouble importing enough food since the Icelandic currency lost most of its value. This, among other things, caused the Icelandic people to be more dependent on themselves and on their nationals. The reason that did not happen –at least not significantly- in European countries such as the Netherlands might be that the Dutch (and other Europeans) are mainly self-sufficient (within the Euro Zone) and thus weren't affected as much by loss of currency value. The population size might also contribute to this since Iceland is the 24th least pop-

ulated country and the 9th least densely populated country in the world with only 3.0 inhabitants per square kilometre (Worldometers, 2016).

Current situation

It was not until late 2010 for Iceland to see any economic growth (Ólafsson & Kristjánsson, 2012).

Fossil fuels have triggered globalisation and centralisation of the food market (Sundkvist *et al.*, 2001). These fossil fuels are finite and the depletion of fossil energy accelerates when the demand for food and services increases (Pimentel *et al.*, 1997). It is important to understand the interactions between ecological and socio-economic systems. This can be done by carefully analysing the framework (Cameron, 1997; Sundkvist *et al.*, 2001). To accomplish and preserve environmental sustainability, constraints should be placed on resource consumption (Ólafsson *et al.*, 2014).

Because of its low costs, the international transportation market is ever growing in both volume and distance (Van Veen-Groot & Nijkamp, 1999; Sundkvist *et al.*, 2001). Due to this introduction of greater diverse food on the food consumption market, Iceland has become more dependant on imported food. This might bring food security into jeopardy if for some reason (due to an extreme loss in currency value or a natural hazard) the import is not executable (Jóhannsson, 2011). Iceland relies for 95% of its total food supply on imported goods, according to an estimation by Bailes & Jóhannsson (2011).

Self-sufficiency is lacking in developed countries due to resilience the international market has to offer to compensate for local shortages (Pimentel *et al.*, 1997; Sundkvist *et al.*, 1999). The country obtains all of its electricity and heat from renewable resources (Scientific American, 2008; Orkustofnun, n.d.), but food supply is mainly imported.

Two events that have proven the instability of the imported food market are the overnight collapse of the Icelandic economy in 2009 (Boyes, 2009), which made importing goods too expensive, and the eruptions of the Eyjafjallajökull in 2010 (Gudmundsson *et al.*, 2010) that disrupted the air traffic in all of Europe and thus made importing goods via air nearly impossible.

Iceland uses solely renewable power sources for their energy use and space heating. The country can be considered a precursor in this field. Since fossil fuel is a finite resource, sooner or later the transition to renewable sources has to be made.

By producing all of this by hydropower and geothermal power, Iceland is completely self-dependant and will be very resilient when facing difficulties in the future. Food security on the other hand is not as steady. Considering the largest part of Iceland's food originates from outside the country's borders, food security is at risk. A back up plan for food security needs to be composed (Jóhannsson, 2011) since natural hazards and economic hardship have proven to have a large impact on the availability of imported goods.

Conclusion

Iceland as a country has known both economically prosperous times and economic hardship in the recent past. With the changes to import restrictions since about 50 years ago the food in Iceland was more diverse than ever. The free market reforms led to large economic growth and the financial sector in Iceland rapidly into one of the worlds largest for its gross domestic product.

The economy was doing great until the financial crisis in 2008, which had many consequences for the country. Most of these consequences were very negative, such as unemployment, debts, problems with importing goods and an increased suicide rate. Fortunately, there were some positive consequences, such as the reduction in air pollution and increased social cohesion. In late 2010 Iceland saw economic growth again for the first time since the beginning of the crisis.

Since Iceland is very isolated by its location and should be able to maintain its food and energy security if import should fail. This is a very real scenario, proven by the financial crisis. Iceland is able to produce plenty of food on its own soil and the food production industry remains a significant part of the Icelandic economy. Of course production in Iceland does not have the same diversity importing offers, but it does offer food security. Energy is not a problem since Iceland is self-sufficient using over 99% renewable power sources.

All together Iceland is in a good position to improve to let its economy grow, while maintaining food and energy security in times of crisis. Whether the crisis is caused by the economy or natural disaster, Iceland should be able to look after its citizens.

The answer to the question if Iceland's economy should be considered isolated is quite clear. Due to Iceland's dependence on other countries for its total food supply, its large international banking and its strategic trading location right in between Europe and North America Iceland's economy is nearly the complete contrary of isolated. It can be concluded that the 'laboratory' of Iceland's neoliberal economy has contributed to a successful non-isolated economy, which is not distinctive for 'islandness'.

The renewable energy from Iceland

Bram de Rijk

Introduction

In the present world the main source of the consumption of energy is produced by burning fossil fuels such as coal, gas and oil. By burning these fuels there is carbon dioxide released into the air. The emission from burning fossil fuels is one of the biggest source of contribution of carbon dioxide in the air and is namely produced by humans (ScienceDaily, ?). This carbon dioxide in our atmosphere is the main reason for the present climate change (Milieu Centraal, 2015). Besides this contribution on the climate change, the burning of the fossil fuel for energy can't keep ongoing because it is a finite source (Ecotricity, 2011. & CIA Worldfactbook, 2012), as shown in table 1.

Therefore, the role for renewable energy and sustainable energy is important. The definition of renewable energy used in this research is: the energy which has a resource that is naturally replenished on a human timescale like sunlight and wind (Ellabban et al, 2014). Instead of the old way of producing energy, burning fossil fuels, there are big opportunities for renewable energy. So it is important for countries to invest in these renewable and sustainable energy markets. When countries do this they will be less dependent of the countries which sell fossil fuels. These investments are especially important for isolated countries such as islands, because the price for transporting fossil fuels to isolated places and countries will rise, as shown in table 2, whereby it will be hard for these isolated countries to buy those fossil fuels in the future (Compendium, 2014). While renewable energy will be cheaper and more reliable source of energy in the future.

One example of one of those isolated countries, which are investing in renewable energy, is Iceland.

As the figures in table 3 shows Iceland is almost completely sustainable and independent concerning the production of energy. In 2011 Iceland only used 19% fossil fuels to generate energy (Gipe, 2012). The policy making of the Iceland government has even resulted in the savings of 350 million tons in carbon dioxide in the past century, and through a policy of ecological utilisation it could reach up to 50 million tons of carbon dioxide annually, which in six years is equivalent to the annual emissions of France, with a population of 66 million (Orkustofnun, 2015).

So Iceland is one of the biggest investors and users of renewable and sustainable energy. However, the profit margin is not high enough and could get a lot higher (Orkustofnun, 2015). There is still a quite significant amount of fossil fuels being imported to Iceland (Orkustofnun, 2015). So the question to ask is: Can Iceland become fully self-sufficient on generating energy by and renewable and sustainable source? And can Iceland sustain the top position on renewable energy? To answer this question this research will cover the history of the energy supply of Iceland. After we have formed a historical background we will look into the situation of the present day and eventually we will end with a perspective on the future and a conclusion.

Iceland's history on energy

Iceland is an island located between the North Atlantic Ocean and the Arctic Ocean. Nowadays everybody thinks of Iceland as a country with geothermal activities and energy, but this wasn't always the case. In this chapter we will briefly introduce the history of producing energy in Iceland.

The earliest source of energy use in the mid-19th century were peat and dried sheep-dung, which were used for cooking and heating. They used these materials instead of wood because there was a scarcity of wood in Iceland, because most of the available wood was completely frozen during the year (Agusta et al, 2006). Like most countries the modern energy utilization started with the industrial revolution.

The very first power stations were built and operational in 1904. These were hydro power turbines, which generated 9 kW energy (Agusta et al, 2006). These hydro power turbines used water and the velocity of the water streams to generate electricity (Office of Energy Efficiency & Renewable Energy, 2015). After this first success in 1904 in a couple of decades more power stations with hydro turbines were built. The Iceland government also introduced the Raforku-*malaskrifstofan*, which means a State Electricity Authority and nowadays is called the National

Energy Authority (NEA). They are responsible to electrify the rural areas of Iceland and for the maintenance of the power stations (NEA, z.j.). The responsibility of the NEA to electrify all of Iceland succeeded in 1984, by then every region had access to hydroelectric power and diesel stations. These diesel stations were used as an energy supplier after World War II and in from 1965 until 1984, but these stations are nowadays only used as a backup (Agusta et al, 2006 & Baröadóttir, 2004).

The use of geothermal energy is possible through the location of Iceland in the middle of the oceans. It is located astride one of the Earth's major fault lines, namely the Mid Atlantic ridge. This is the middle of two plates which are moving away from each other. Therefore is a big mantle plume created, which generates a lot of heat that warms up the water and creates the volcanoes (Algar, 2015). Through this mantle plume geothermal energy is available for Iceland (Bjornsson, 2010).

To get to these underground hot springs to heat water, scientist first had to do a lot of research to know where and how to drill to reach the hot springs. Within in a few years scientist had enough information and started to drill into the surface to search for these hot springs (Björnsson, 2010 & Baröadóttir, 2004). After a while they hit the right spots to reach these hot springs, shown in table 5 and 6. To utilize the warm water from the hot springs there were wells needed. The working of these wells drilled in the surface is shown in table 7 (Björnsson, 2010). On the front page there is an picture which is on first sight probably controversial because of all the industries and the smoke. But this is actually a working well where energy is produced. So it's actually not a harming industry with the smoke.

The use of the geothermal activities as an energy source also started at the beginning of the 20th century and resources nowadays more than the half of the Iceland's primary energy needs. Around 1900 scientist started with the research in these geothermal activities with these geothermal activities as energy source. They started to experiment with the use of geothermal activities for heating. They started with the build of pipe lines in a hospital, swimming pools and 60 houses. Through these pipes they pumped boiling or very hot water so that the homes or swimming pools were heated (Bjornsson, 2010). This experiment turned out to be a success and more pipe lines were built for heating houses (Bjornsson, 2010). After the enormous oil price hikes in the 1970's the government of Iceland started to promote these geothermal ways of heating and producing electricity. As result of this promoting by the government the geothermal energy use for space heating rose from 43% to 83% within 14 years, as shown in table 4, and it was 87% in 2005 (Bjornsson, 2010). So the role of the government is this development of using geothermal activities as a source for heating and electricity rose in a couple of decades.

As we can see the usage of renewable energy in Iceland started in the 20th century. In the beginning people were critical about the use and safety of it, but after enough research and development more reliable methods and technologies were created and the people started to see the profits of it. Due to the rising oil prices and the promoting of the Icelandic government the usage of these renewable energy source increased and almost double with a few decades. Now we got the background information of the renewable energy usage of Iceland, so in the next chapter we will discuss the present day situation about usage of these source.

The present situation around the renewable energy

Nowadays Iceland is the 22th country in the world as to producing electricity from hydroelectric plants and number 8th in the world as to producing electricity from other renewable energy sources, such as wind and geothermal activities (CIA World Factbook, 2012). On the other hand, Iceland is not importing any crude oil or gas any longer. The only thing they import, energy wise, is little refined petroleum products (CIA, World Factbook, 2012). So the main energy resource nowadays is just like in the past and even more nowadays from renewable and sustainable sources.

The wells which have been drilled in the last century are still producing energy today in Iceland. Nowadays however the scientist can use the newest technologies. So the efficiency of the wells and the drilling of new wells increased due to the newest research and development. But besides these profits of the newest technologies the scientist is also more precarious with drilling because of the volcanic reactions (Bjornsson, 2010). They are more precarious by these newest technologies, because they can monitor the consequences of the drillings better. Hereby they got more information and they realize the hazards of it more and better (Maochang, 2001 & Ingimarsson, 2012).

The energy resourced by the hydropower stations and the geothermal energy is mainly used for the industry of Iceland. In table 7 is show how the energy consumption in Iceland is divided. The second biggest

consumer of the energy in Iceland are the buildings. They namely use the energy for heating and lighting (Nordon, 2015). The Ministry of Finance & Economic Affairs in Iceland administers two big energy-related funds: The Research Fund and the Technology Development Fund. The Research Fund allocates five million euros annually in competitive grants for basic and applied research in a range of topics including energy. The Technology Development Fund allocates four point five million euros annually in grants for technological research, where energy is also funded (Nordon, 2015). By giving these funds a big investment annually the progress of getting better, cheaper and more reliable energy is growing every year. So the Icelandic government is supporting the research and development of reliable renewable energy sources.

Because these investments in research people might think that Iceland is a very energy neutral and friendly country. However, Iceland has one of the highest energy consumptions per capita in the world (Nordon, 2015). The explanation of this is found in the way of exporting the unutilized energy. Unlike most island, which uses and therefore import a lot of fossil fuels for their energy, Iceland has virtually 100% renewable energy sources. Whereby the inhabitants of Iceland don't use and need all of these energies. So Iceland got surplus of energy. Unfortunately, Iceland doesn't have the facilities to export these surpluses of energies directly to other countries. So instead of storing this energy, they use it in power intensive industries such as aluminium production (Baröadóttir, 2004). These products are wanted by other countries, because it is energy and power intensive and therefore expensive to produce. So Iceland exports these products and namely the aluminium products to other countries. So Iceland exports the energy indirectly by these products (Nordon, 2015 & Observatory of Economic Complexity, 2015 (OEC)). These industries almost consume two thirds of all the electricity and in combination with just 320.000 inhabitants the energy consumption per capita in Iceland is huge (Nordon, 2015).

Besides the export of power intensive industrial products, Iceland nowadays also exports the knowledge of harnessing geothermal energy. Through the long history of working with renewable energy sources, mainly the geothermal energy, Icelandic scientist are one of the best of the world in this field. Therefore many other countries with unexploited geothermal resources want the knowledge of the Icelandic scientist and import these scientist and knowledge (Orkustofnun, 2015).

The usage of renewable energy sources is in Iceland nowadays still important and even increased, but what we have seen from the history of the renewable energy in Iceland it is not only important for the country itself. With the current situation of globalisation, the interests in the power intensive industrial products derived from Iceland has grown and the export of Icelandic knowledge and know how concerning mainly geothermal energy, but also hydropower energy, has grown as well.

The future of Icelandic energy

With the current climate change crisis and debates the interest in renewable and sustainable energy is growing every day. People start to realise that burning fossil fuels can't go on forever because it is finite, so the need for a solution rises so that we can keep living like we do now, but without using fossil fuels. The current situation as described in the previous chapter has shown us that Iceland is one of the top leaders concerning renewable and sustainable energy. Through the annually investments in the energy related funds the government is stimulating the research and development in the energy sector to keep the top position in the world (Nordon, 2015).

A big question is the change of exporting the unutilized energy of Iceland. As seen nowadays the exports goes by the production and exporting of power intensive industry products. The goal of the Icelandic government is to change this. In the early 1950's there was already the idea of a submarine cable to export the energy. Through the annually investments this technology is considered feasible, but still remains on the margin of becoming economically feasible (Bjornsson, 2010 & Baröadóttir, 2004). The cost of electricity would double if it is exporting from Iceland to continental Europe. Through this continental Europe won't be interested in this energy, because it is more expensive than the energy from the competitors. So for now the favour still goes to the policy of producing and exporting power intensive products, but through the continuing research it might be possible in the future (Bjornsson, 2010).

The drilling process to create more and new wells to extract heat for producing energy, the geothermal energy, is also improving through the investments of the Icelandic government. In 2000 the Deep Drilling Project (IDDP) started, whereby three drilling companies along with the National Energy Authority and the Iceland Geosurvey started to work together (IDDP, 2015). The goal of this alliance is to research the feasibility of extracting energy, chemicals and other useful products from hydrothermal systems at supercritical conditions. These supercritical conditions consist of deep wells where the pressure and heat is bigger than the normal wells. (Bjornsson, 2010. & IDDP, 2015). To reach these hydrothermal super critical conditions there is a highly advanced drilling technology required, which the alliance is busy to create with for so far success. In January 2014 the world's first Magma Enhanced Geothermal System (EGS) was created (IDDP, 2014). The Deep Drilling Project succeeded to drill a well at a depth of 2100 meters with a temperature of 900-1000 Celsius (IDDP, 2014).

Besides the geothermal energy and the hydropower energy Icelandic scientists also researched the use of alternative fuels. These studies concluded in the early 1990's that the production and usage of these re-

searched alternative fuels was not economically viable (Bjornsson, 2010). However nowadays with the research and developments in the fuel cell technologies could provide a new way of producing energy for Iceland, but this technology still needs a lot of research.

Next to this research the Icelandic government initiated a new project named A Forum on Alternative Fuels. The goal of this forum is to encourage a more efficient energy use in the areas where nowadays the fossil fuels are currently being used. Besides this the forum is also trying to increase the use of environmentally friendly energy carriers (Bjornsson, 2010).

Conclusion

The Icelandic situation concerning energy is unique. It is the only country in the world where the geothermal activities are so well used for generating electricity. As we can see from the history there were already interests in these activities to generate electricity. In the 20th century people already started with drilling and experimenting with the use of the geothermal ways of producing energy. Not only the geothermal energy where researched, but also the hydropower energy was researched and developed. Through these early researchers and developments, the current situation of Iceland is created. As seen in chapter two Iceland nowadays is one of the top leaders concerning renewable and sustainable energy sources. The current production of energy in Iceland is more than enough for their own inhabitants, therefore the remains of this energy are used in the power intensive industries. The products from these industries are exported to other countries. Not only their products, but also their knowledge and know how is exported.

The Icelandic government is stimulating the renewable energy sector by creating funds and investing in them. By doing this the government is trying to stay in the top position concerning renewable energy. By this the future concerning renewable and sustainable energy sources for Iceland is looking bright.

So to answer the main questions of this research: Can Iceland become fully self-sufficient on generating energy by and renewable and sustainable sources? And can Iceland sustain the top position on renewable energy? Yes, Iceland is going the right way to become fully self-sufficient on generating energy by renewable and sustainable sources. The Icelandic government is stimulating the research and development annually to increase the self-sufficiency of Iceland. As shown in the tables and figures the amount of importing fossil fuels is decreasing in the last few years and will keep decreasing in the future, because of the increase of renewable energy.

The role of Iceland in the renewable energy sector also will be high, because as we have seen the relative long history with working with renewable energy created experience with the Icelandic scientists. This experience is still wanted in other countries of the world. Iceland is nowadays not only exporting power intensive products, but also the knowledge and know how around geothermal and hydropower energy sources.

*Obair na gcianta * The work of generations*

Reny van der Kamp

Introduction

In the present world the main source of



Source: www.ireland.com

Introduction

The Aran Islands are situated on the west coast of Ireland. Three islands, Inis Oir, Inis Meán and Inis Mhór. Old land, dating from a period between 325 and 350 million years ago- consisting of the same Lower Carboniferous limestone as the area of the Burren on Ireland's mainland. (Feehan, Book of Aran, 1994). Since approximately the Middle Ages there are no trees on the islands, and no natural soil. So to fertilize the land the people used seaweeds. Seaweeds grow all around the islands in massive amounts. The seaweeds were spread over the field and mixed with sand. Through the centuries that has turned into soil. This process continues till today. (Robinson, 1986) There are walls, as far as the eye can see until the rocks meet the ocean. The walls have been erected to for a few reasons: first to somehow free the ground from the litter of stones all over the islands. Second to protect the cattle and crops from the often strong winds. Third to control the pasture on each field in between the walls. (Robinson, 1986).

In Irish history a huge event changed the whole country: the Great Famine, which struck between 1845 and 1852. A potato blight that destroyed most of the harvest was the main reason. Many people died, and many emigrated to America. O'Brien (1921) mentions a huge increase in emigration numbers in the first years of the famine.

The west of Ireland suffered enormously, even more than the rest of the country. It was remote, poor and much influenced by the harsh weather conditions along the Atlantic Coast. But somehow the famine seemed to have a less destructive effect on the Aran Islands. The community seemed more resilient in facing the crisis. In fact, as Messenger (2001) writes, some farmers on the islands even exported potatoes to help feed the needy mainlanders. What was the reason for that? And can we learn something from it regarding the famine risk which is currently threatening Sub Sahara Africa? In this paper I try to make clear that, while similar circumstances took place both on the Aran Islands and on the Irish mainland, yet the sense of community and the agricultural structure made the inhabitants of the islands more resilient. First I explain the situation and the lifestyle on the Aran Islands in the 19th century. Then I will look at some theories on famine and resilience. A combination of the Aran life and famine theories is then made. Concluding the pa-

per I argue that we can learn from this situation looking at today's famine crisis in a close-knit community in a landlocked Sub Sahara African village.

Life on Aran

When we look at daily life on the Aran Islands just before the Great Famine, it's mid-nineteenth century. As Anne O'Dowd writes, (*The Book of Aran*, 1994) most of the descriptions of life on the Aran Islands in those days had a nostalgic tone: 'a way of life on the verge of oblivion' (p 195). Isolated islands, a vivid Irish local language -Gaelic-, a strong local community and a very special landscape all contributed to the romantic idea. However, there was hardly a reason for a romantic point of view.

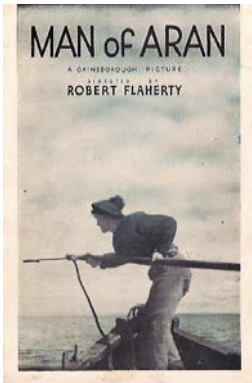


fig1



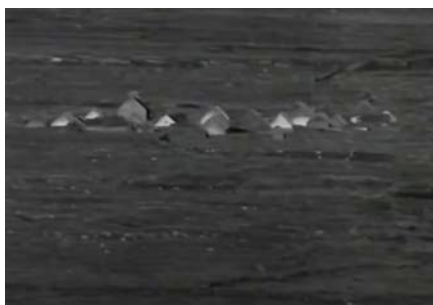
fig2 (photo Bill Doyle)



fig3 (Ordnance Survey Map)

For his 1934 film 'Man of Aran' (poster, fig1) the American documentary filmmaker Robert Flaherty stayed on the Aran Islands for short periods during 2 years to film daily life on the island. His footage of the strong winds, the wild sea, the landscape and the perseverance of the people is stunning. With only a few characters he paints Aran life.

Much criticism was received by Flaherty though. The main issue in the critique was his romanticising the primitivism of the island life, and the fact that many situations in the film were not according to reality (Messenger, 2001). Still, the film shows much of how life must have been.



stills from ' Man of Aran' 1934

Synge's *The Aran Islands* was also written after the famine period, in 1907, but much of the lifestyle on the islands was still the same. Some of the main occupancies during the day were: growing potatoes and other crops; fishing; collecting seaweeds for fertilising the soil and for the kelp industry on the mainland; transporting goods, animals and people with a

curragh to the big steamer; spinning wool; weaving, knitting and sewing clothes; digging peat and restoring or erecting walls. Synge tells of a strong local culture, with gatherings and storytelling. All major events such as funerals and celebrations were shared. On the islands the natural resources necessary for daily life were widely available, like wool for clothes, rye for straw and sheepskin for pampooties (shoes) (O'Dowd, 1994). This made the islanders very independent. In fig. 3 we see some of the pastures surrounded by walls on a part of Inis Mhor. The structure of the field patterns is geologically laid out by the ridges and fissures that are formed in the limestone. (Klimm, 1935)

The main meal on the Aran Islands, like in most parts of Ireland, consisted of potatoe. In fig. 4 we see the cultivation pattern over the country (Nat. Center for Geocomputation, 2010). Also fish was on the menu, but less frequent. Fishing was rather difficult in the often wild sea around the islands (O'Dowd, 1994). Other crops that were cultivated were wheat, cabbage, turnip and rye, while cattle, sheep, horses and chickens were either bred or kept by the islanders. (Messenger, 1969)

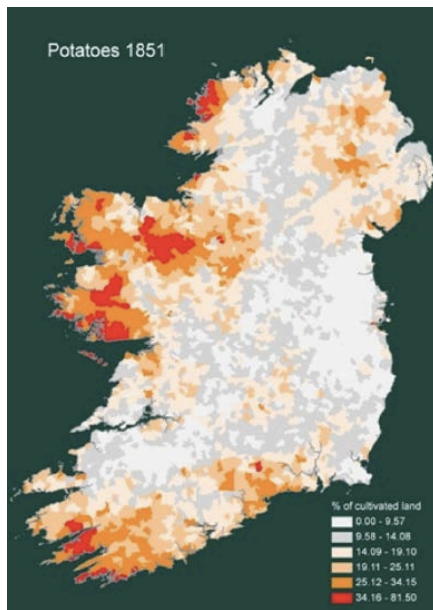


Figure 4 (N. C. G., 2010)

Famine crisis and famine resilience

The Irish potato famine of the 19th century has been considered by some as a classic example of a Malthusian catastrophe: the population growth and the availability of food are out of balance. But human suffering from famine is hardly due to a lack of food alone (Flaherty, 2013; Duflo&Banerjee, 2011). Factors such as social structure, political situation, economic processes and environmental changes play a role as well.

Vanhaute (2011, p 51) states that famine can be looked at as “an event (sudden crisis), a process (accelerated destitution) and a structure (the breakdown of societal networks)”. He pleads for an integrated research. Looking at Ireland during the Great Famine; the event was clearly the potatoe blight. The process was fuelled by the agricultural circumstances such as poor soil and

small pastures with monoculture. The structure related to the landowner-tenant-dependency and the poor-law-evictions that took place.

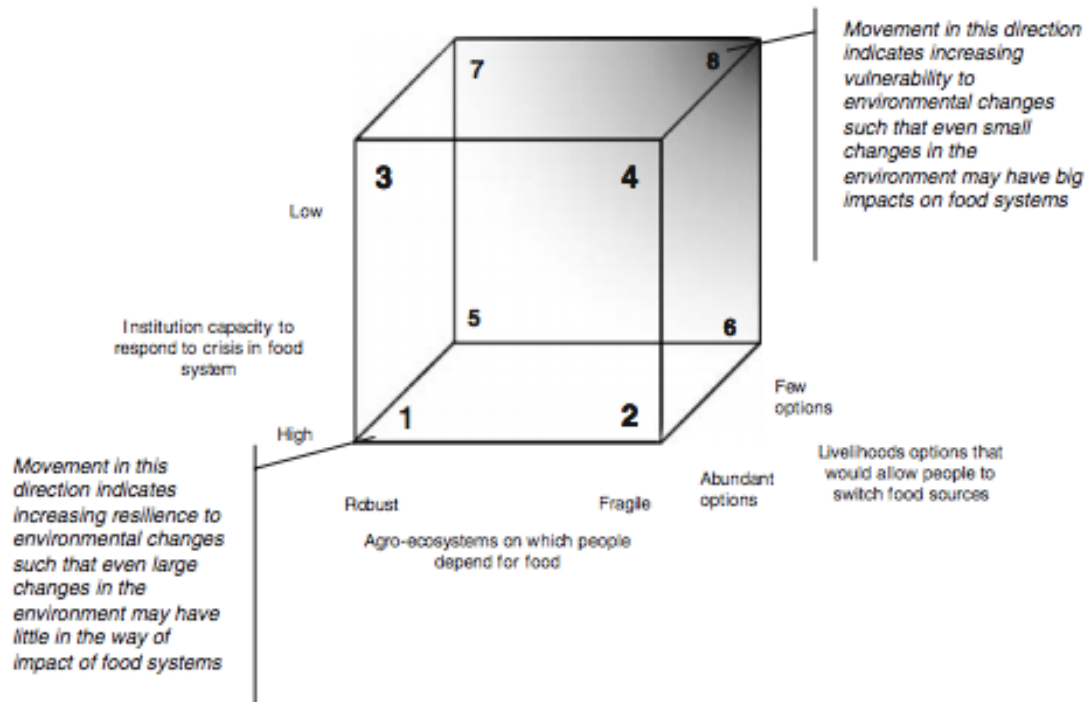
Fraser (2007), in his study to understand famines, argues that three factors stand out in affecting vulnerability to environmental change:

First, “changes at the agro-ecological level affect the degree to which agricultural productivity is sensitive to changes in the environment” (p 508). Especially in the west, where soil was poorer than in other parts of Ireland, the potato was a great gift when introduced from America in the 16th century. Presumably brought by Spanish fishermen who carried potatoes in their vessel as food for the journey, taken from the West Indies where the crop originates. (Mc Neill, 1949). This increased the productivity of their farms in the short-term but ultimately made them very vulnerable because of the monoculture.

The second key characteristic according to Fraser that stands out as important is “the degree to which the worst affected people were unable to change their livelihood strategies and find alternatives when agricultural systems failed” (p 508). Through poor soil in which not many crops could grow, high population rates, rather large families and loss of industries such as textiles, the Irish were completely dependent on growing potato; a crop that could not even be stored for an entire year. Duflo & Banerjee (2011) describe the relation between being poor and having (not) enough nutrients to eat. They discovered that, although families are poor, when money is available they would not always buy food richer in nutrients; they would often buy food they regarded as tastier. Sometimes they would not buy food at all, but spend their money on festivities such as funerals, christenings etc. Duflo and Banerjee’s research is not historical, but we can imagine the Irish poor being provided

with the 'poor relief' (see third point below) would not always buy what we now consider as healthy- given the assumption that there was a choice at all.

The third important point is the key role of institutions like governments, churches, landowners and so on. In Ireland's case, the (British) government's main famine relief policy was the 'poor law'. That law, finally enacted in 1838, was based on relief for the very poor in Irish society: women, orphans, tenant farmers. In exchange for giving up their land and become day labourers they were provided relief. Eviction was one of the aims of the design of the law-similar to the Highland Clearances in Scotland in the same period. It certainly helped against starvation, but was insufficient because of poor circumstances (O'Grada, 2007) and many farmers chose to remain independent (O'Brien, 1921).



In fig 5 we see a visualisation of the impact of the three key points according to Fraser (2007)

Amartya Sen writes in 'Development as Freedom' (1999) that the famine in Ireland was fuelled by a lack of initiative from the British government. In fact there was no lack of food, but a 'food countermovement' happened in which food was transported from poor Ireland to wealthier England. People there simply could afford to buy food, which the majority of the Irish couldn't. The government just let it happen. Besides that, the Irish were seen as lazy and unproductive, and by their limited diet made themselves victims of the blight- as he cites Charles Edward Trevelyan who was the British Head of the Treasury during the famine in Ireland.

The Aran Islands and the Great Famine

Now when we have a look at the Aran Islands taking into account the above studies of famine we might get an idea why the effect of the potato blight was less destructive here.

When famine is a sudden crisis (Vanhaute, 2011) and is related to the agricultural productivity and the degree of sensitivity to changes in the environment (Fraser, 2007); There were other crops as well as fish, however in small amounts, to be consumed when potato harvests were affected. So when the blight hit the potatoes there was generally enough extra food to feed the population.

And when we look at the process of famine (Vanhaute, 2011) and people's (un)ability to change their livelihood strategies and find alternatives when agricultural systems fail (Fraser, 2007): the fertility of the land for each individual farmer was much better on the Aran Islands because of the traditional fertilising methods. The soil enrichment with nutrients

had been a process of trial and error. The farmers on the Aran Islands had found a way to optimise the scarce availability of soil without exhausting it. The so-called Sweet-Spot- theory according to the lecture by Dr. Rijdsdijk (2015) indicates that soil nutrients have to be in balance for optimal crop growing. Household location and soil conditions are directly related according to research on Hawai'i for instance. Also the FAO states in the 2015-year-of-soil campaign that sustainable use of soil can improve crop growing. (FAO.org, 2015)

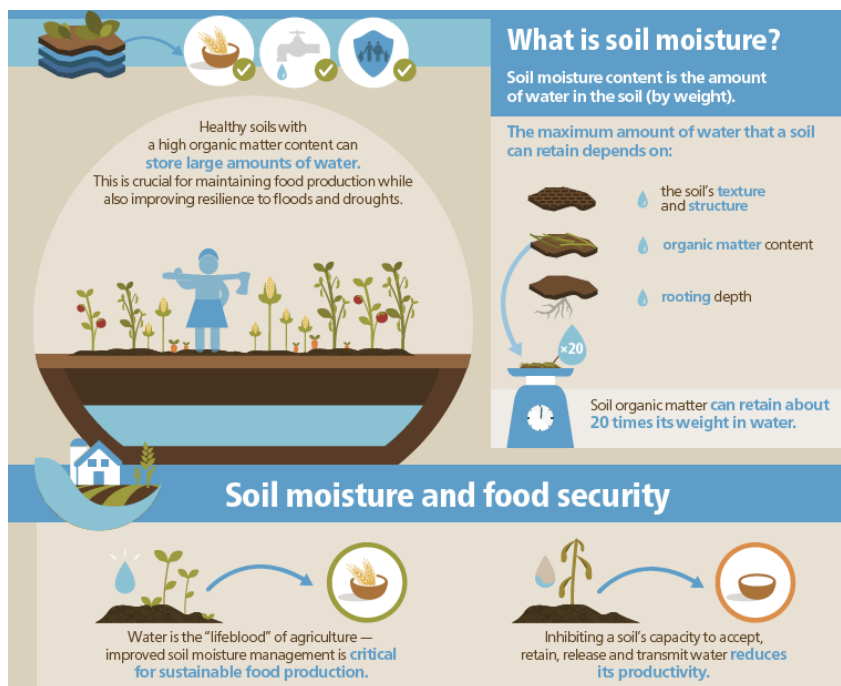


Figure 6:
<http://www.fao.org/soils-2015/en/>

Because of other activities -such as seaweed collecting for the kelp industry- people could earn some money to eventually buy food and be able to pay their land-owner for the use of the land.

As Royle mentioned in his Islands lecture (2015): islands within their insularity face severe limitations when it comes to economic activity. There are 2 ways to cope with this: specialisation and generalisation.

With all the different activities on the Aran Islands, the latter was the case. This led to a poor life for most, but presumably during the famine period it supported them. They did not rely on potatoe alone, like in the west of Ireland's mainland. As the community was close-knit, people were coöperating in daily life. Seaweed could only be transported with mutual effort, for instance.

In 'The Aran Islands' (1907) Synge describes an event where the bailiff comes with a team of armed police and a doctor for the eviction of cottages and the seizure of goods and cattle of families in debt. "Till this year no one on the island would act as bailiff, so that it was impossible to identify the cattle of the defaulters. Now, however, a man of the name of Patrick has sold his honour, and the effort of concealment is practically futile. Yesterday morning a letter was nailed on the doorpost of the chapel: Patrick, the devil, a revolver is waiting for you. If you are missed with the first shot, there will be five more that will hit you" (p 43).

Royle and Dodds (2003) also mention the importance on islands of belonging and kinship for social knowledge and common heritage, while economic activities are often "social anchors" (p 488).

While famine is also embedded in a social structure (Vanhaute, 2011) and institutions in the community play a key role, (Fraser, 2007) we see that livelihood, land dividing and many other occupations were more or less social activities on the Aran Islands. The church played an important role as well as strong local traditions. In the year-round rituals and festivities all islanders took part. Many of the church services and rituals were about mutual memories, gratefulness and companionship (Clancy, The Book of Aran, 1994). Also on the Aran Islands relief works were carried out by the government -some of the 'famine' roads are still visible- but to a much lesser degree (Robinson, 1986). The insular community life was less influenced by what the government far away in Britain decided. The food countermovement (Sen, 1999) only took place as an economic activity to export surplus yield.

To summarise; the main elements of a less destructive effect the famine had on the Aran Islands can be recognised as:

- *A community-based society with a strong sense of belonging and kinship.
- *A resilient agricultural economy with more than one focus.

- *Deep knowledge of the soil fertility and agricultural methods for successive generations.
- *Either government measurements that contributed to the wellbeing of the islanders or such 'far away measurements' that they hardly effected the community.
- *A staple crop, rich in nutrients.

Discussion

What can we learn from this while looking at the current famine threat in Sub Sahara Africa?



fig 7: De Correspondent 2015

Take the village of Dickisoni in Malawi as an example, completely landlocked. Malawi is one of the poorest countries in the world; according to the Human Development Index 2015 Malawi is ranked 173 out of 190. 66,68 % of the population lives in severe poverty; 1,25\$ or less per day. The current situation is threatening many civilians in the country (UN report, October 2015). Last year the rains were poor, so the crops were too small. The result is that now, while the season of rains just started, the food supply is finished in many families. Not enough to eat. Therefore, children don't go to school, small businesses go downhill for no one can afford their services and so on. A famine is likely, however the government of Malawi has promised swift action and cooperates with the World Food Programme to alleviate hunger for 2.8 million Malawian citizens. (Wittenberg, 2015)

Knowing the rural rural community quite well I see many similarities between Dickisoni and the historical circumstances on the Aran Islands. The village is very isolated; besides very small villages nearby, the nearest small town is more than 30 km away and most inhabitants never leave the area during their life. The agriculture is heavily depending on weather conditions and the plots of the farmers have to be tilled each season; there is not enough available land to let it rest. Also the agricultural methods have hardly changed over the last generations. The community is close-knit, strongly catholic and marriage and families are a central point of community life. Modern times have changed the community somewhat; some people have a mobile phone, a radio or a bicycle.

The staple food of Malawi is maize. Maize is pounded, dried, grinded into flour and cooked into porridge-like lumps known as nsima. No matter the level in society, for a Malawian there is no meal without nsima. Most farmers in Malawi grow maize for family consumption. In their dimbas –winter garden near the river- they grow other crops such as tomatoes, sweet potatoes, sugar cane, beans and onions. Additionally, some of them grow tobacco to sell on the market. Often the turnover of tobacco is low. Most of the farmers depend heavily on government-subsidised fertiliser to cultivate their land. Organic manure is used, but on a much smaller scale and as the land is tilled non-stop, soil fertility is decreasing. Severe deforestation is taking place as well. (Wittenberg, 2007)

To what extent is the Aran Islands resilience reflected in the situation in Dickisoni?

A community-based society with a strong sense of belonging and kinship:
This is the case in Dickisoni. Funerals and weddings are important social events. The village has a communal garden, in which food is grown for people in need such as elderly women. However, when families have to struggle to survive solidarity diminishes. (Wittenberg, 2007)

A resilient agricultural economy with more than one focus:
That would be an improvement for Dickisoni. Other focuses than maize and tobacco could be found in additional staple crops, breeding animals and crafts. Trade opportunities are a problem for the farmers in this area. Transparency in prices, reachability of markets and government support are lacking (Wittenberg, 2007)

Deep knowledge of the soil fertility and agriculture methods for successive generations:
Soil fertility methods are rather poor in Dickisoni; a high dependence on industrial fertiliser makes farmers too vulnerable for weather changes. Deforestation through wood cutting (kindling for cooking, construction, coal production etc) is also a huge problem: no conservation agriculture and a lack of humus soil through leaves. With soil improvement as proposed by the FAO, farmers would have better chances in keeping their crops grow. Finding the sweet spot (Rijsdijk, 2015) while using their land is becoming more and more a matter of life and death. Fraser (2007) also emphasises the importance of peasants in facing the world's food issues. When the eco-system is more robust, small scale farmers are more resilient in changing from one staple crop to another if necessary.

Either government measures that contributed to the wellbeing of the islanders or such 'far away measures' that hardly effected the community:
Subsidising fertiliser is almost the only measure the Malawian government is taking to assist the farmers. Much more could be done in: improving sustainable farming, soil enrichment methods, education, gender issues, innovation and trade.

A staple crop, rich in nutrients:
Maize when it's processed into nsima is low in nutrients. All the fibres are gone. The tradition is: the whiter the better (Wittenberg, 2007). Interesting would be to search for methods how to respect tradition while improving knowledge to stop destroying the nutritious fibres. A lack of nutrition is especially problematic when the diet has limited elements like in many countries in Sub Sahara Africa. (<http://www.fao.org/nutrition/en/>)

Conclusion

Central to this paper was the question why the Great Famine which struck Ireland from 1845 till 1852 had a less destructive effect on the Aran Islands, and what we could learn from that regarding current and future famine crises in Sub Sahara Africa. Reading through this paper we have seen that the main elements of a less destructive effect the famine had on the Aran Islands can be recognised as: kinship, knowledge, independence and diversification of skills.

Knowledge of the history of famine resilience can help to improve future famine risks; it has been shown by many academic writers. We see that on the Aran Islands the isolated strong local community together with a deep knowledge of the land used for agriculture and a generalisation of activities helped the islanders in their resilience against the famine that struck the Irish mainland in an atrocious way. The islanders were less dependent on one staple crop than on the mainland. In the current situation in Sub Sahara Africa with a famine likely to happen some of the encounters can be helpful. While landlocked, its villages face an almost similar isolation as islands surrounded by sea. The insularity is mirrored in the isolated position of such villages in a country with severe poverty, a strong sense of community, a lack of resources and a poor infrastructure. Also we have seen that agricultural methods quite similar to the ones used on the Aran islands find audience nowadays in contemporary sustainable ideas.

I argue that these conclusions can be adopted:

- *Focusing on -and eventually restoring if necessary- the sense of kinship in rural villages.
- *Improvement of soil to gain resilience against fertility decline.
- *Sharing knowledge and skills among farmers to improve local and innovative methods.
- *Diminishing dependency on industrial fertiliser by upscaling the production and use of organic manure.
- *Researching the relation between local tradition and nutrition knowledge.
- *A strong sustainable policy by the government.

These elements could possibly be effective in the process of reducing the famine-risk threats of climate change in the small rural communities of Sub Saharan countries such as Malawi, learning from past generations on the Aran Islands.

Conclusion

As we have seen throughout this chapter there are different perspectives from which one can look at an island.

From a cultural view regarding the music of Iceland it had been concluded that islands characteristics are key in understanding the success of the music scene. The creativity and originality of the musicians, which is the main reason Icelandic musicians are internationally successful, stems from island-challenges: the lack of a strongly organized music business leads to a productive Do-It-Yourself-mentality; the need to show your capabilities and look over the borders of your own island leads to international recognition; the close communities lead to plenty of collaborations and an easiness to arrange concerts. Thus, the islandness is an inherent part of the Icelandic music success.

When regarding Iceland from a biophysical point of view it has been concluded that desertification is a significant problem on the island. It is also very complex due to the many factors that are at play. Those factors are erosion, climate, soil, land-use and advancing sand fronts. However, it is possible to solve the problems if the positive track is continued. The main factor contributing to this positive prospect is the sociological structure of Iceland.

From an economic perspective it can be concluded that the 'laboratory' of Iceland's ne-liberal economy has contributed to a successful non-isolated economy, which is not distinctive for 'islandness'. Due to Iceland's dependence on other countries for its total food supply, its large international banking and its strategic trading location right in between Europe and North America Iceland's economy is nearly the complete contrary of isolated.

Even though the location is very remote and the country does face some difficulties if ever transportation of imported goods would fall short, the trade is a large part of the Icelandic economy and it makes the country closer to the continental mainland of both Europe and North-America than it is geographically situated.

The energy view consists mainly of the transition of Iceland to a renewable, self-sustaining energy system.

A historical analysis of the Aran islands can tell how important a strong relation with the community as well as the landscape is for a sustainable lifestyle. The impact of the famine in Ireland during the 19th century has been devastating for the mainland, but less so on the Aran islands. A strong sense of kinship and a deep knowledge of the soil and landscape supported the islanders in their struggle with famine and poverty.

Looking at a general conclusion regarding the European Coldwater islands in this chapter, a few elements stand out, and can be a source of inspiration in a broader perspective:

- The importance of a strong social structure. We have shown that in the research on Iceland's music scene, the process to stop desertification and the famine resilience on the Aran islands.
- The importance of a sustainable use of the land available: to stop desertification and to fertilise the land for agriculture.
- A supportive governance with a focus on kinship and sustainability. With many players in society and economy, the governance has to play the major role.
- Isolation is a relative concept; it can fuel developments rather than slow down. The thriving music scene on Iceland, and the economic developments on Iceland are good examples of that concept.
- Independence, isolation and trade are different aspects of the same islandness. The position of Iceland in between Europe and the United States of America has a positive effect. The isolation and independence of the Aran islands surrounded by sea created the trade opportunity with the seaweeds for the kelp industry on the mainland. Independence drives trade in a way.

Discussion

Combining these disciplines there are several conclusions that can be drawn.

One of these is that a good government is a very important aspect in achieving sustainable practises on an island. Considering the energy of Iceland for instance, it is the government that plays an important role in stimulating the renewable energy sector. This is done by creating funds and investing in them. The desertification on Iceland is also combatted by an agency established by the government. However, the people on the Aran islands were quite independent, and the measurements the (British) Government took hardly effected them. Which was their blessing, because on the mainland the government was hardly able to cope with the famine crisis.

Another conclusion is that the way in which a society functions is an important aspect of solving problems. On the Aran islands it is kinship that is one of the main elements of the less destructive effects the famine had on the islands. In working on solutions for the desertification problems on Iceland it has probably helped that people identify themselves so much with the island and its environment. From a cultural point of view it is stated that the dense Icelandic social networks makes it easier to form bands and arrange concerts.

The role of isolation is also a common factor in the analyses of different disciplines. For example from a cultural perspective it has been found that the isolation makes the independent sound of Icelandic music possible. Isolation also had an effect on the bio-physical environment of Iceland as it has made the vegetation of Iceland very vulnerable to over-grazing. This is because the vegetation developed in the absence of herbivores. The isolation also plays a role in the economy of Iceland; it is especially important for a remote island to have an adequate amount of food production available for its own population. The isolation played a role as well on the Aran islands. The remoteness made the islanders very independent. They had to be creative in using their scarce resources.

Even though it was possible to draw general conclusions based on the analyses it should be noted that it was not possible to take all aspects of the islands in consideration. For instance individual factors such as people's happiness have not been considered. The unique biodiversity of Iceland and the Aran islands has also not been discussed in detail. In addition, tourism is also a factor that has barely been examined. To be able to give more reliable conclusions it would be advisable to also include factors such as these in further studies.

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Fiji and Nauru: Island analogies

A case study of Nauru and Fiji



Figure 1. Logo of the IIS course Islands. source (Norder et al., 2014).

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Abstract

As part of the South Pacific region, this book chapter involves the examination of Nauru and Fiji. Both countries face deterioration of some of their indispensable ecosystems that support human life. Ironically, the deterioration of these ecosystems were initially caused by several human activities. In Nauru, these activities were mainly fueled by the pursuit of profit from phosphate resources. The Fiji case shows that these activities can set positive feedback mechanisms in motion, which lead to unexpected losses in environmental and monetary terms. Both cases demonstrate that the consequences of these activities lead to a negative impact on social, economical and environmental entities, which require a lot of effort and money to solve.

These consequences could have been avoided if sustainable governance and expertise knowledge was adapted beforehand. Unfortunately (for them), islands are the small scale laboratories that serve as models for the larger picture. By looking at their mistakes or accomplishments, we are able to adapt to current threats, learn crucial skills and prevent apocalyptic scenarios.

Introduction

This book chapter combines two case studies of the islands Nauru and Fiji. The research questions are respectfully *“To what extent could Nauru serve as a warning sign for our global political and economic system and its trajectory?”* and *“Which adaptation will need to be made to mitigate the effects of climate change on Fiji’s ecosystems and economy?”*.

While the two island are very distinct in their geographical characteristics, economic and political institutions and history; similarities have been found with respect to climate change and ecosystem management. In the Nauru article, the main focus lies upon the analogy between Nauru and our global system, and how humankind can learn from their mistakes. For example, Nauru’s reliance on resource exploitation (phosphate), its environmental deterioration and its overconsumption are highly similar to our global system. The societal and economic problems that have emerged in Nauru during the last century are mostly products of these practices.

However, there is one threat that they did not create: climate change and global warming. These problems threaten us all, and especially island states. The article about Fiji thoroughly examines the trends, consequences and solutions of climate change, that can be extrapolated to other islands as well. Moreover, it discusses the risks of poor ecosystem management with mangroves and coral reefs in particular.

In the sections below, both papers can be read and studied. Subsequently, an analysis will be made of the common grounds by discussing the similarities between the islands and what kind of lessons can be learned by looking towards islands as models for our planet. Finally, a recap of the found conclusions in each article will be displayed, while it will be finalized by a confronting take home message.

Nauru: cursed by resources



Image 1: Aerial photo of Nauru (ABC, 2015)

“To what extent could Nauru serve as a warning sign for our global political and economic system and its trajectory?”

Name of island: Nauru

Topic: Economy & Culture

Author: Thomas Budie (thomasbudie@me.com, 10660607)

Amount of words: 3277



Image 2: Location of Nauru (Wikipedia, 2011)

Introduction and relevance

On the equator in the Pacific Ocean, a small island with a grand story lies in isolation. After 3500 years of primitive conditions, the first European contact in 1789, followed by German colonization in 1888, led to profound changes to the islands' ecology, culture and economy (Connell, 2006). In 1900, deposits of concentrated phosphorus were discovered underneath the islands' top soil, which is a rather uncommon characteristic for small islands. During its emergence, the island was an old seamount with a small reef above it. Subsequently, birds reached for this place to eat shell animals, rest and excrete. These bird droppings accumulated and formed a thick layer of 'guano' which got covered by sand and gradual soil formation: Nauru's Genesis (Vuuren, Bouwman & Beusen, 2010).

In 1907, the Pacific Phosphate Company started mining activities, which after the First World War was continued under British-Australian administration. This produced large revenues which even gave the country in 1985 one of the highest GDP per capita in the world (Connell, 2006). However, besides the great conveniences that were enjoyed by the Nauruan population, through phosphate exploitation they literally dug their own grave. Ecologically, the entire inland of Nauru has become devastated through deforestation and soil removal. The traditional culture of fishing and agriculture disappeared (Klein, 2014). And finally, Nauru has become a victim of the 'resource curse' or 'Dutch disease'. The high revenues from phosphate production resulted in wage inflation and exchange rate appreciation, which led to the decline of production in other sectors like agriculture and industry (Connell, 2006). Moreover, improper investments and financial sanctions by the international community (because of money laundering in Nauru) increased the financial debt (Thomas, 2013). All of these problems and threats are created by the visions and practices of Nauruans, colonists and foreign stakeholders, but another threat arises where they hardly contributed to: climate change (Klein, 2014).

This paper will examine the similarities between Nauru and our global system, in terms of our economy, culture and the created environmental issues. Since Nauru is a system with closed ecological boundaries, our modern society could learn from the mistakes taken at this former tropical paradise. Therefore the research question is "To what extent could Nauru serve as a warning sign for our global political and economic system and its trajectory?". This question will be answered by reviewing Nauru's history and future prospects, reflected against system Earth. Firstly, the resource curse will be explained and what influence it had on other economic and cultural sectors. Secondly, the environmental deterioration will be examined. Thirdly, the transition between resource revenues and banking/investments incomes will be outlined. And finally, the current status and future trends will be analyzed.

Analysis

In pre-contact times, the Nauruan population counted little more than 1000 people. The island had been populated by Micronesians around 3500 years ago (Connell, 2006), which divided the land ownership among 12 different tribes. In the future, this would be rather significant because of the distribution of phosphate reserves and revenues.

Traditionally, Nauru's economy was based on coconut and pandanus cultivation, and aquaculture. However, productivity was rather low because of certain ecological circumstances, resulting in a low carrying capacity (Williams and Macdonald, 1985). Frequent droughts hampered growth of coconuts and pandanus in the coastal fringe. And because of the absence of a lagoon and reef, strong ocean currents and a low oceanic productivity, fishing was rather difficult (Connell, 2006).

All of this changed as soon as the German prospector Albert Fuller Ellis discovered high phosphorus contents in the heart of the island. Driven by the growing fertilizer demand in the Western world (population growth, higher consumption and different consumption patterns), the British 'Pacific Phosphate Company' overtook the organization and exploitation of the mines, which actually were part of a German protectorate. This came into practice because of an agreement with the Jaluit Society, granting them a monopoly on guano exploitation. In return, the population would seat a minority in the directorship, while a share of the profits would be received (Hiery, 1995). This share was subsequently distributed among the government (50%), landowners, the Nauru Local Government Council and the Nauru Phosphate Royalties Trust (Connell, 2006). The common Nauruan priorly did not benefit from these activities, resulting in poor social justice and unequal wealth distribution.

During the First World War, the island became occupied by Australia and stayed under its administration until its independence in 1968. From this moment on, Nauru achieved full control of their own reserves, perceiving that this would provide the financial basis for future development. Furthermore, it would serve as an economic compensation for its small island size (Glassner, 1992). For a few decades, it actually seemed that the phosphate royalties would succeed in these goals since a welfare state was emerging. Health care, public transportation, education and water and electricity became free, while housing subsidies and the absence of taxes made it a paradise for its inhabitants. However, as it has already been mentioned, instead of sustainable long-term prosperity the large revenues of phosphate exploitation led to financial, ecological and cultural issues.

One of the mechanisms at play here is the 'resource curse' or 'Dutch disease'. This term has been created in 1977 to describe the decline in the industry sector in the Netherlands after a huge gas field was discovered in 1959. It is the causal relation between economic development through natural resources and the decline in other sectors such as agriculture. Wasteful spending of sudden high incomes are unavoidable, while long-term issues evolve because of wage inflation and exchange rate appreciation. This happens because the export of resources leads to the appreciation of the real exchange rate (currency rate), which impedes the competitiveness of other sectors since their products are becoming more expensive in the global market (Kutan & Wyzan, 2005). Besides financial drivers, cultural changes also destroyed educational structures and the working atmosphere (Connell, 2006).

By 1953, the agricultural system already suffered massive neglect and deterioration. Farmers were uninterested in farming practices and the fertile soils had been removed in order to reach the buried phosphate reserves that covered 90% of the island (McDaniel & Gowdy, 2000; Saundry, 2012). Ironically, a large part of the island has become infertile while its main export product is fertilizer. By the 1980s, agriculture and fruit cultivation disappeared almost entirely of the island. Due to this and because of the fragility and monotony of the Nauruan diets (coconuts, fish and pandanus), large amounts of processed foods were imported, while fresh food became rare and expensive. This led to very high calorie intakes, resulting in many negative health implications such as obesity and diabetes

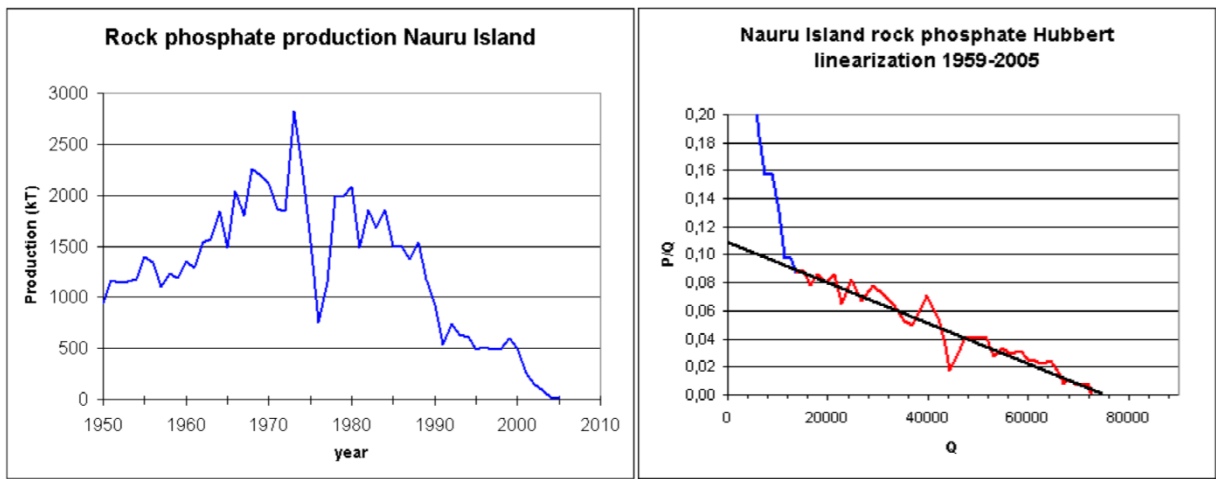
2. At the end of the 20th century, Nauru had one of the highest rates of diabetes and obesity in the world, while average life expectancies declined to 56 years (Shenon, 1995; Thomas, 2013).

The easy inflow of money and the accompanying laziness also resulted in the disappearance of crucial skills. Since the beginning of mining activities, the workforce consisted of migrant workers from China and 'nearby' islands such as Kiribati. No more than a total of a few hundred Nauruans were ever employed in the mining industry. Instead, adults were predominantly interested in small businesses, governmental functions and NPC office employment. Nauruan adolescents rarely graduated from high school and less continued with further education. Additionally, teachers and nurses were recruited overseas. This failure in developing a skilled workforce was a clear result of the disproportional revenues by resource exploitation (Connell, 2006).

Besides negative feedback mechanisms to its economy, the mining industry had an adverse effect on Nauru's environment as well. In the 60's, Nauru still was a very picturesque island, seen from the sea. However, this was nothing more than a Fata Morgana. Nowadays, behind the thin coastline, a graveyard has emerged: the removed forests and soils reveal the million years old limestone skeletons of former coral reefs. Because around four-fifth of the inland has been hollowed down until these pinnacles (some can reach heights of 75 feet), a so-called oven effect has come into force. This plateau creates a column of scorched air that rises up fast enough to drive away rain clouds (Shenon, 1995). Persistent droughts limit Nauruan fresh water supplies, and the population is now dependent on an old desalination plant and fresh water imports from Kosrae and the Solomon Islands (Connell, 2006). Moreover, many indigenous plants and animals that were of economic importance for Nauruan people are gone or endangered (Gowdy & McDaniel, 1999).

On top of this, Nauru has also become threatened by a crisis that has not been created by Nauruan people: climate change and the combined droughts, ocean acidification and sea level rise. If global warming predictions are accurate, the rise of sea levels will flood major parts of the island with the fertile thin coastal areas in particular. The only 'habitable' area would be the desolated inland called 'Topside' (Gowdy & McDaniel, 1999).

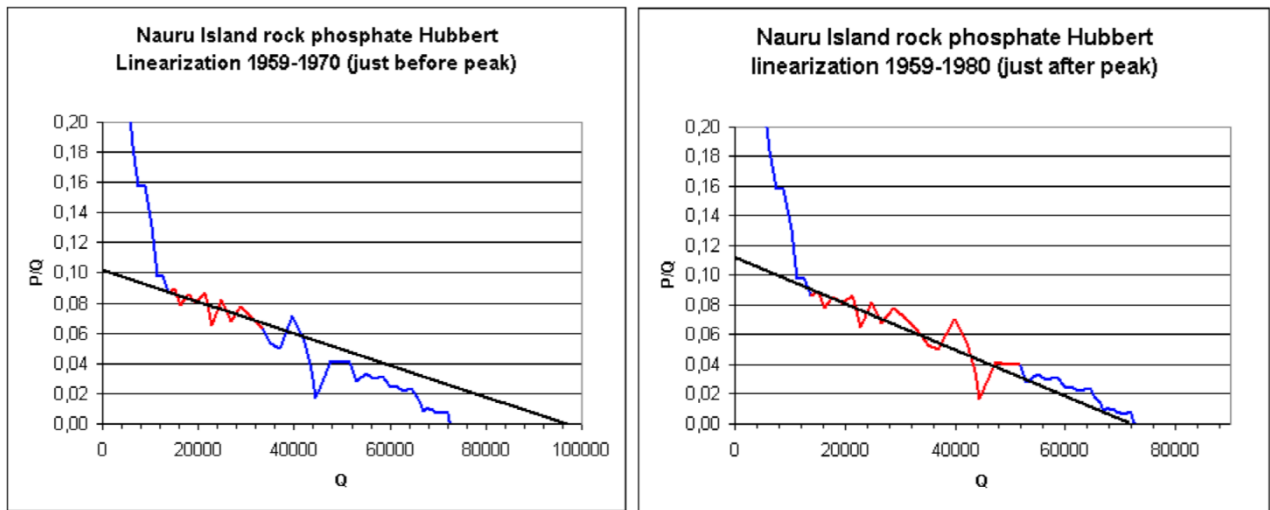
During the 20th century, a few Nauruan policy makers were already aware of the fact that phosphate reserves would deplete at some point. Déry & Anderson (2007), have used the peak oil theory in order to see if Nauruans could forecast 'peak phosphorus' prematurely. In 1956, M. King Hubbert forecasted a decline in U.S. oil production around 1970 by using his bell-shaped Hubbert curve. An oil peak occurred in 1971 proving Hubbert's predictions was very accurate (Patterson, 2015). With respect to this study, the theory says that the extraction of phosphorus results in higher investments and thus a higher extraction rate. Eventually, this will lead to the decline of phosphate concentrations until economic infeasibility/physical depletion (Singer & Menzie, 2010). In the case of Nauru, Déry produced a Hubbert Linearization and found an Ultimate Recovery Reserve (URR) of 77,000 kT and a phosphorus peak in 1973.



Graph 1 (left): Rock phosphate production in Nauru (Déry & Anderson, 2007).

Graph 2 (right): Rock phosphate Hubbert linearization 1959-2005 (Déry & Anderson, 2007).

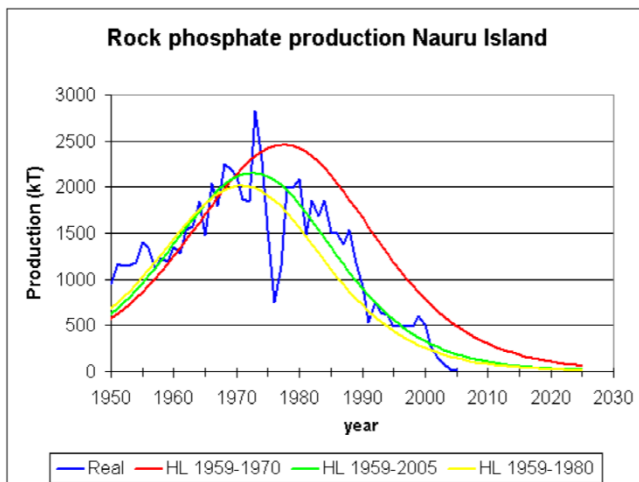
While these results are currently facts, the question is whether complete depletion could have been forecasted before or after the peak. Study has shown that linearization before the peak produces an URR of 97,000 kT (peak date in 1978), while after the peak gives an URR of 72,000 kT (peak date in 1971).



Graph 3 (left): Rock phosphate Linearization 1959-1970 before peak (Déry & Anderson, 2007).

Graph 4 (right): Rock phosphate Linearization 1959-1980 after peak (Déry & Anderson, 2007).

As it can be observed, the linearization after the peak gives the most accurate prediction, since the URR is just slightly smaller (-6,5%). The graph below shows an overview of the differences between multiple linearization timings.



Graph 5: Rock phosphate Linearization with different timings (Déry & Anderson, 2007).

Given this information, Nauru could have foreseen that their phosphate revenues would decline rapidly after the peak in 1973. When Nauru became independent in 1968, they did try to reduce dependency on the phosphate exploitation by investing a large share of the mining incomes into real estate and other project (Klein, 2014). With royalties from the Nauru Phosphate Royalties Trust, the airline Air Nauru was created and expanded, while expensive office buildings and several businesses around the world would serve as a new income generator. Kuwait was considered as a 'model' and the investments were supervised by the Australian company 'Philip Shrapnel & Co (Connell, 2006). Unfortunately, this plan failed because of improper investment counseling and the mining profits were declining more rapidly than expected (Thomas, 2013). Helen Hughes, an Australian economist, estimated in 2004 that if Nauru would have properly invested \$1,8 billion dollars between 1968 and 2002, the capital could have grown to \$8 billion dollars or \$4 million dollar per family (with a household of 5 people per family) (Thomas, 2013). Currently, the GDP of Nauru is only \$36.9 million dollars (Asian Development Bank 2011).

As a result, Nauru needed foreign money and increasingly began promoting itself as a tax paradise. Neither personal nor business taxes existed (Thomas, 2013). However, financial deregulation occurred gradually during the emerging global free trade policies (e.g. WTO), which resulted in obscure practices: fake banks emerged that had no form of control, supervision, taxes or legislation (Klein, 2014). Nauru transformed into a money laundering paradise. Especially Russian mafia transferred their money into this place: \$70 billion dollars of Russian capital flight occurred in 1998. Some authors even say that this is one of the reasons behind the economic collapse of the Russian economy (Connell, 2006). In the current proliferation of money laundering centra, which is estimated as a \$5 trillion dollar shadow economy, "Nauru is public enemy number 1" (Hitt, 2000).

A review in 1999 led to the statement that modernization of legislation was required in order to regulate the banking sector. In 2000, President Harris and its government designed new legislation that would repel money laundering, by suspending offshore banking services and improve its accountability. However, the international Financial Action Task Force (FATF) judged the legislation as insufficient and imposed new financial sanctions: western banks were not permitted to make any money transfers with Nauru. Furthermore, because of money transfers with suspected terrorist organizations, Nauru was even more investigated (Connell, 2006). The degree of these sanctions are comparable to those against Iraq and former Yugoslavia (Shenon, 1995).

The resource curse has had an enormous impact on Nauru's economy and political environment. Furthermore, the societal effects have been disastrous. Because of huge debts and financial sanctions, oil imports could not be paid, public transportation ceased, telephone services were disconnected, banks and ATMs went out of service and the NPC and government employment got scaled down leading to high unemployment rates (Connell, 2006). Today, the financial debt is estimated around \$869 million dollars (Thomas, 2013).

Furthermore, the last decade has introduced a new problem. In order to gain new incomes, Nauru has declared itself as an Australian detention centre for refugees (Bryant, 2013). With respect to the Pacific Solution, Australia's marine captures refugee boats and displaces them on Nauru (Connell, 2006). However, the conditions are as horrible that Amnesty International and the United Nations High Commissioner for Refugees describe the conditions as incompatible with human rights (Klein, 2014). While this refugee camp is highly advantageous for the Australian government, Nauru's society is becoming more and more troubled, because it is leading to civil unrest and higher crime rates (Connell, 2006).

Comparable issues happen around the world, whether this is in Nigeria or Venezuela, but there is one feature that is key for this situation. Namely, all these issues can be ascribed to the geographical location of Nauru. Because of its isolation and its remoteness from the rest of the world, it has been possible to turn this island into a junkyard. A place to produce waste, launder money, dump refugees and disappear as a whole.

This holds true for global problems as well, knowing but not knowing at the same time. Whether this is for waste disposal or CO2 emissions, the illusion of proximity and distance is one of the key mechanisms of our economy. However, Nauru is the perfect example that this mechanism is self-destructive. And although the global society is becoming more and more aware of their existence in a closed system, the economic system still strives for endless growth.

Another parallel to our global system is how developed countries are becoming wealthy at the expense of poor nations. The majority of Nauru's phosphate export was destined for Australia and New Zealand in order to fertilize their poor agricultural soils, while a large share of the revenues was also under Australian administration. In return, rehabilitation payments in 1993 only comprised \$75 million, which is a small fraction of the damages that have been done (Shenon, 1995).

Besides similarities between island characteristics and the 'Spaceship Earth' theory, Nauru also displays some typical island problems such as small populations and markets, few skills, minimal resources (besides former phosphate reserves), expensive transportation and dependency on external services. For numerous years, Nauru enjoyed an economy that relatively complied to Baldacchino's PROFIT model. However, currently it seems that there is no economic model that suits Nauru properly. The SITE model does not fit since tourism is absent (Nauru is the only island that lacks in the Lonely Planet South Pacific travel guide). Nor does it match with the MIRAB model, since it depends much more on foreign aid than overseas remittances (Baldacchino, 2006; Connell, 2006; Tisdell, 2014). All of this together makes this island highly peculiar and more vulnerable to further stresses.

Today, Nauru suffers from political unrest, financial crises, ecological deterioration, cultural losses and climatic threats. It would be perfectly entitled to accuse foreign countries such as their past-colonialists, harmful investors and CO2 emitting countries for these problems. However, many Nauruans regard themselves as a warning for the rest of the world. In 2011, Nauru's former president wrote: "Nauru is an example for systems with closed ecological boundaries". The world must learn from the mistakes made by the island inhabitants and lose the extractive characteristic of its culture and economy. "Nauru is not the only one that has dug his own grave, the entire world is doing it" (Stephen, 2011).

Conclusion

This article has shown how a beautiful pristine island in the South Pacific can be transformed into a living hell in less than one century. Priorly, Nauru was solely appreciated by colonists because of its convenient location. However, the discovery of phosphate rich deposits altered Nauru's fate immensely. The exploitation of this agricultural fertilizer has led to major ecological devastation, while the resource curse had significant consequences for its economy, culture and society. Traditional practices disappeared, soils and vegetation got stripped away, health issues arose and self sufficiency evaporated.

Decolonization did not result in the required improvements in spite of an extraordinary high GDP per capita, investments in real estate and the attraction of foreign money. Furthermore, climate change imposes a new threat that cannot be solved by themselves. What is next?

One possible solution is to rehabilitate the inland, import topsoil and fertilizers and start rebuilding the ecosystem/agriculture. However, the costs for this are enormous. Nauru currently receives a substantial amount of foreign aid (note: Nauru receives aid at one of the highest rates of GDP in the world), but it is estimated that it should receive at least \$181,5 million dollars in the next decade in order to complete this rehabilitation process (Toatu, 2004; Connell, 2006).

The second solution is rather dramatic, but with the current ecological and societal problems it seems like a lucky opportunity: emigration. Unfortunately, just as the refugees in its detention

centre experienced, it is rather difficult to find asylum in other countries. While you would think that after all the trouble that Australia has caused during those decades, they should be at least willing to make it easier for Nauruans to immigrate, let alone pay higher aid rates. Yet, they are still very reserved on this subject. Perhaps because of similar demands from other island inhabitants.

Nevertheless, the physical capability of emigrating to another place is rather comforting and even a privilege compared to the world. For as far as we know, humankind is unable to emigrate to another place, meaning there is no alternative than solving our problems by ourselves. There is no doubt that this will be difficult. It will probably be the biggest challenge of mankind. But as John F. Kennedy once said, which is quite ironic in this case: *"We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard"* (Kennedy, 1962).

Fiji: Threatened by climate change



Figure 1. coral reef and tropical island. Source: self-made.

Name of Island: Fiji

Topic: Coastal protection in Fiji

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Introduction

Fiji is the fifth largest archipelago in the world, with a total population of 860.000 and people having an average salary of \$25.000 it is one of the main hubs in the Pacific Ocean and one of the most developed Pacific Island economies. However, Fiji, and other islands around the world, are currently being threatened by climate change. Their coasts are eroding and the land is swallowed by the sea. In order to prevent that from happening, many countries adapted a coastal program. In island nations, this coastal program takes on a different roll than in other nations. Island nations are completely surrounded by ocean without bordering other nations on land and therefore have a much higher coastal area to land content ratio. Fiji is no exception in this case, with 85% of the total population living at the coast, just within a few kilometers of the ocean (Mimura, 1998). As a result, the economical activity is heavily concentrated around and focused on the coast. With such a population density so close to the coast, the effects of climate change can cause major catastrophes and problems. Climate change will probably affect all the people living close to the coast physically or economically. It is therefore not peculiar that the coastal program on Fiji occupies a major part of the politics and legislation.

To see what the future holds, it is interesting to predict how big the effect of climate change will be. This paper investigate the effects of climate change on the ecosystems, economy and urban areas of Fiji. The central question this paper will seek to answer is therefore: Which adaptations will need to be made to mitigate the effect of climate change on Fiji's ecosystems and economy.

To answer this main question orderly, three sub-questions will try to be answered. These questions are consecutively:

- How will the climate in Fiji change in the following decades?
- What are the consequences of climate change to the coastal areas of Fiji?
- Which measures can be taken to mitigate the effects of climate change on the coastal areas of Fiji?

In this paper, we will start off by outlining the expected future changes in climate characteristics due to climate change accordingly to the latest outcomes from several researches. Subsequently, the effects of climate change will be discussed in the following paragraph. Afterwards, information from both paragraphs will be combined to give us an insight in future developments and finally, we will look to what Fiji currently does, and can do to prevent disasters and mitigate the effects of climate change.

Figure 2: Location of Fiji on the world. Source: Wikipedia 2011.



Trends in climate change

In order to investigate the impact of climate change on the coastal areas of Fiji, it is important to know to which extent climate change will alter climate characteristics in the South Pacific Ocean where Fiji is located. The effects of climate change can be divided into three sections; sea level rise, an increase in average annual temperature and precipitation and an increase in extreme weather severity & frequency.

Starting with sea level rise, it has been estimated that current sea level rise in the South-Pacific is around 2 mm/year. The rate of sea level rise is increasing by higher temperature, because ice caps melt quicker and the seawater gets warmer so that it expands more. Therefore, sea level rise will increase with enhanced climate change, leading to an even bigger sea level rise in the next decades. This may lead to a sea level rise of 11 to 21 centimeter in 2025 and 23 to 43 centimeter in 2050, depending on the future amount of humans greenhouse gas emissions (IPCC, 2014).

Next to sea level rise, the annual average temperature will also increase due to the greenhouse effect. The exact amount of temperature increase is still fiercely being discussed, but estimations are around a few degrees by the year 2100. The exact predicted temperature increases according to the IPCC for the South Pacific Ocean are presented in table 1.

Subsequently, climate change will alter weather events. Amongst other things, this will lead to a greater difference in the amount of precipitation and will increase the concentration of rainfall events within a period. As a result, the precipitation in wet periods will be higher and last longer, which can even lead to river floods (Kostaschuk et al., 2003). While in dry periods, the precipitation will be less, which can lead to freshwater shortages. Luckily, Fiji biggest islands got a relative large freshwater supply for an island, but the agriculture and the smaller islands of Fiji will likely be subject to drinking water shortages if dry periods will become drier (UNFCCC, 2005). The amount of change in precipitation has been calculated with models called General Circulation Models (GCMs), the future changes in precipitation are also shown in table 1.

As a last, climate change will enhance extreme weather events, making storms such as cyclones and hurricanes more severe. According to the latest IPCC report (2014) tropical cyclones in the South-Pacific have increased in activity, especially during El Niño events. Webster et al. (2005) found that the occurrence of the severest two categories of cyclones doubled in the last 40 years. With climate change increasing, this trend will likely to only set forth. More severe cyclones and hurricanes are therefore to be expected within the coming decades.

Table 1. Forecasts of the increase and decrease of rainfall and temperature in Fiji by different emission scenarios. The data within the table was retrieved from UNFCCC (2005), IPCC (2007) and IPCC (2014).

Predictions And GCM results	Emissions Scenario	2025		2050		2100	
		Temp (°C)	Rainfall (%)	Temp (°C)	Rainfall (%)	Temp (°C)	Rainfall (%)
During wet periods	B2 (mid)	0,5	3,1	0,9	4,6	1,6	10,5
	A2 (high)	0,6	3,4	1,3	6,7	3,3	14,6
During dry periods	B2 (mid)	0,5	- 3,5	0,9	- 5,7	1,6	- 9,7
	A2 (high)	0,6	- 3,9	1,3	- 8,2	3,3	- 14,0

Effects and threats

As covered in the previous paragraph, the average temperature, the sea level and the severity and frequency of storms will all increase in the coming decades. Yet, we do not know what the effect of these processes are on the beaches of Fiji. In this paragraph we will look at the effects of climate change on the coastal environment of Fiji.

The shorelines of Fiji are covered with mangroves and the oceans are filled with coral reefs. Fiji got the third biggest total mangrove area in the Pacific Ocean and possesses ten thousand square kilometer of coral reef, making it one of the major coral reefs in the world (Jenkins et al. 2004). Naturally, beach erosion is being constrained by natural obstacles, which mainly consist of mangroves and coral reefs. Mangroves reduce the wave impact on the shores due to breaking the waves and providing low energy environments for sedimentation (Ellison, 2010). Coral reefs act like an underwater seawall and can reduce the wave energy up to 97%, contributing significantly to the reduction of beach erosion (Ferrario et al. 2014).

However, these natural protection systems are under treat of climate change. Coral reefs are very vulnerable to the warming of seawater. When sea temperatures rise above 30° Celsius, the essential symbiotic algae located on the corals called zooxanthellae quickly die out, a process which is called 'bleaching' of corals. Periods with consecutive days with a sea temperature above 30 degrees can be catastrophic to coral reefs, which contribute to 70% of all coral bleaching (Hoegh-Guldberg, 1999). In 2000 a warm period in Fiji caused a mortality rate between 40 and 80% of the hard coral species, it took five years until the hard corals were as abundant as before the 2000 event (Morris, 2007).

Furthermore, coral reefs are also prone to extreme storms. As stated earlier, most of the energy of the waves is absorbed by coral reefs. With a storm or cyclone active in the area, wave energy is greatly enhanced, leading to breaking of coral branches and overall erosion of the coral reef. Yet, storms can also have a positive influence on coral reefs. During a very warm period, storms and cyclones will cool off the water, which prevent bleaching from happening. Subsequently, storms might break off living coral, but it also removes dead corals. This creates more places for new coral to settle, which speeds up the restoring process (Morris, 2007).

Not only coral reefs, but also mangroves are under threat of severe storms and sea level rise. Hurricanes and cyclones affect mangroves in a way that they are being damaged directly, which includes loss of leaves and breaking off of branches. However most of this damage is not lethal, so that mangroves can recover fairly rapidly. The main problem is suffocation of mangroves by widespread sediment displacement, as mangroves are being rather intolerant to sudden burial by sediments (Ellison, 2010). Even more threatening to mangroves than storms is the ongoing sea level rise. Mangroves can only keep up with a sea level rise of a few millimeters per year. Depending on the amount of sediment accumulation, so-called low island mangroves can only keep up with a sea level rise of 1,2mm per year and high island mangroves with a sea level rise of 4,5mm per year (Ellison, 2010).

Additionally, the deterioration of mangroves stimulates the destruction of coral reef systems, which leads to more wave erosion and thus creating a positive feedback mechanism. Morris (2007) even suggests that the disappearing of mangroves could be the greatest threat to coral reefs systems in the next 10 years.

Within mangroves there is a lot of loose muddy sediments, when the mangroves disappear, this sediment is not longer fixed. The sediments are then picked up by the energy of the waves and are deposited on top of the reefs in the ocean in front of the shores. The first consequence of this process is that the released sediments will block the sunlight, which leads to less productivity and deterioration of the existing coral reefs around Fiji. Secondly, the sediments will fill the spaces between rocks, creating a less ragged seafloor environment. Both effects results in a decline of habitat diversity and biodiversity of the oceanic reef systems (Terry, 2004). In addition, the flattening of the seafloor causes a reduction in the amount of obstacles on the seafloor. In return, this leads to less wave energy to be absorbed and thus a greater wave impact on the beaches, thereby increasing shoreline erosion.

However, climate change is not the main reason for the destruction of coral reefs and mangroves. Human activities in Fiji have actively contributed to the deterioration of these systems and therefore boosted shoreline erosion. These activities include practices such as clearing mangroves, reclamation of land for agriculture and unsustainable fishery. Also indirect human influence such as water pollution and acidification greatly contributed to the perishing of these ecosystems. For instance, acidification of ocean water also causes bleaching of corals. This effect is globally active due to increasing CO₂ levels in seawater, but on a local scale, direct pollution through sewage and industrial discharges causes mass bleaching of nearby coral reefs (Ellison, 2010).

Mangrove clearing has been the most significant threat to mangrove existence, which was greatly supported by the Fijian government in the early and mid 20th century (Mimura, 1998). Prior to 1960, there was almost no extensive shoreline erosion. Coastal vegetation was present all-around the Fijian islands, naturally protecting the beaches. Only when human population size increased and the inhabitants started to alter their environment on a larger scale, it was that shoreline erosion has been imminent. According to Mimura (1998) almost all reviewed coastal villages on Fiji are being threatened by beach erosion since then.

Figure 3: Mangrove removal around 1960. One can clearly see the flat surface with sediments where once the mangrove was located. Image was retrieved from Mimura, 1998.



Forecast

In the first paragraph the developments in climate change in Fiji were covered. The second paragraph elaborated on the effects of climate change on the coastal areas of Fiji. If we now combine the information of both paragraphs, which trends can we then predict to set forth?

Mangroves and coral reefs will probably suffer significantly from climate change. First of all, as explained before, some mangroves can only keep up with a sea level rise of 1,2mm per year. With a sea level rise of 23 centimeter by 2050, the sea level will on average rise with 6,5mm per year. This rate will even exceed the maximum rise of 4,5mm per year that mangroves can possibly keep up with. It is therefore very certain that mangroves won't keep up with sea level rise, mangroves closest to the ocean will die and mangroves will move land inwards if possible.

Fijian mangroves have already been heavily affected by humans, it has been estimated that till 2003 the amount of removed mangroves is 30% of the total mangrove area on the Fijian islands (Agrawala et al., 2003). This is roughly ten thousand hectares of mangrove forests, which are mainly cut down to make room for sugarcane plantations. Mangrove destruction have not been standing still since then, around three thousand cubic meters of mangroves is being cleared each year (Ellison, 2010).

Besides mangroves, coral reefs will also suffer greatly from projected climate change. Coral reefs grow on average 20 to 40 centimeter per 100 years (Ellison, 2010). In regard to the consistent rising sea level of 100 centimeter in the year 2100, most coral reefs will not be able to keep up with this rate and thus suffer losses. As elaborated earlier, more damaging than sea level rise is temperature increase and acidification. Most of the losses from these factors will be in inshore shallow coral reefs, because the temperature will be highest and pollution sources are closest. This is a major problem for coral reef expansion, since the relocation of coral reefs due to sea level rise will be upward, and thus towards the shallow areas.

The deterioration of coral reefs will damage Fiji's economy significantly; inshore fisheries alone already have an annual revenue of an estimated \$64 million (Ellison, 2010). A quick calculation shows us that with an expected decline in fishery of 20% will lead to a loss of \$12.8 million per year (Morris, 2007). Local fishermen and villages are very dependent on these fishing yields. Now that climate change is increasing, their way of living is under a certain threat.

Ecosystems will not be the only ones being damaged by future developments. Urban areas and agriculture will also see land loss due to sea level rise and increased damage through more extreme storms. Out of all the agricultural uses, sugarcane farming will be most affected by climate change, since most sugarcane is being produced closest to the shore. Agriculture accounts for around 40% of Fiji's earnings, with a quarter of all arable land being used to cultivate sugarcane (UNFCCC, 2005). Based on models and trends in climate change, the UNFCCC calculated that over the next 50 years one third of the sugarcane production will produce only half of the expected yield. For sugarcane being Fiji's main agricultural good, this expected decline in sugarcane yield will have a significant negative impact on the Fijian economy.

Next to agricultural losses, urban areas will also suffer from climate change. Land lost due to beach erosion differs from place to place due to variety in relief and protection, but there have been reports in Fijian villages of shoreline erosion up to 1 meter per year (Nunn, 2012). As a result, almost all coastal villages on Fiji endured one or multiple relocation of buildings or structures. However, due to physical and cultural obstacles (such as land rights), relocation is not always possible. In 21% of the villages, relocation was hardly or not possible, resulting in relocations of local inhabitants from rural to urban areas (Pernetta & Hughes, 1990). As last, extreme storms also have a major impact on the economy and livability of Fiji. Category 4 or 5 storms kill on average 25 people and also causes around 85 million dollar in damage per storm (Feresi et al., 1999). As the frequency of category 4 and 5 storms will double, economic losses due to storm damage will also significantly increase.

Recommendations

In order to mitigate the effects of climate change, action will need to be. Some of the possible adaptations recommended by the World Bank will be discussed in the following paragraphs. The advantages and disadvantages of different adaptations, together with the related costs will be taken into account.

Constructing artificial breakwaters

Building artificial breakwaters is the most direct interference to protect the land from deterioration of the coastal areas. Artificial protection against beach erosion, such as seawalls, have been and are being applied to various shorelines across the islands. Their function is quite straightforward, they reduce the wave impact and thereby terminate any beach erosion. However, there are some withdrawals with the application of artificial breakwaters. First of all, building seawalls is rather expensive. The costs for construction artificial breakwaters on Fiji are on average \$19,790 per meter (Ferrario, 2014). Secondly, seawalls can even worsen beach erosion if not built and maintained well. When seawalls are built out of loose beach rocks (Figure 2), the waves are able to pick up the rocks, destroying objects with it in its path and creating gaps for more erosion. Subsequently, if the seawall is poorly designed, then the wave energy will just be transferred to a location nearby without a seawall. This increases beach erosion on spots which are not protected by any artificial structure (Ferrario, 2014).

Conserving mangroves

As explained, mangroves contribute to a large extent to reduce the impacts of climate change. Restoring and preserving current mangrove forests therefore seems rather logical. On the one hand, mangrove conservation benefits the local population with providing ecosystem services. Ecosystem services from mangroves on Fiji have been estimated around \$1500 per hectare per year, which involves tourism, fishery and providing raw materials amongst other things (Agrawala et al., 2003). On the other hand, mangrove reclamation for agricultural use largely benefits big companies, which often won't have to deal with climate change and the corresponding costs. However, the ones that have the most influence on the politics are mostly the ones with money, which in many cases are the big companies. Therefore, it is not rather easy to introduce legislation for the conservation of mangroves, so that mangrove protection is mainly a political issue.

Restoring coral reefs

Coral reefs also contribute widely to the mitigation of beach erosion. The costs for restoring an healthy coral reef is estimated around \$1,290 per meter, compared with the construction of seawalls, this is more than 15 times cheaper (Ferrario, 2014). In addition, coral reefs are essential for tourism and local fishery on Fiji, which, together with sugar production, makes up the biggest part of Fiji's economy (Agrawala et al. 2003). Restoration of coral reefs can be achieved by providing foundations for corals to grow on, by mitigating pollution from sewage water and by restricting fishery in some reef areas.

Figure 2: A seawall made out of beach rocks (left) and a seawall made out of concrete (right). From Mimura (1999)



Conclusion

With current trends, climate change will likely enhance due to increasing anthropogenic greenhouse gas emissions. Among other things, this will result in a sea level rise between 23 to 43 centimeter, a temperature increase of a few degrees and an increase in frequency of cyclones and storms in the next 30 years. These changes in climate characteristics will affect Fijian coral reefs and mangroves on a major scale. Both ecosystems cannot hold up with the rate of sea level rise and will thus partly drown. Acidification and the warming of seawater will cause bleaching of coral reefs. Increased sediment displacement due to increasing storms and wave energy will bury mangroves. Large mangroves and reef areas have already been destroyed due to these processes. With enhanced climate change, this will likely increase in the coming decades.

As can be learned from this case study, direct and indirect human activities, such as the clearing of mangroves and the emission of greenhouse gases caused a deterioration of mangroves and coral reefs. This in return will set positive feedback mechanisms in motion, which lead to further degradation of both ecosystems. The loss of related ecosystem services, such as the protection against shoreline erosion and the provisioning of food, will cost millions of dollars and threaten the Fijian local way of living. Restoring these ecosystems in order to maintain their valuable services will cost thousands of dollars per hectare. However, replacing the protective function of mangroves and coral reefs by building artificial breakwaters is far more expensive. In addition, there is a difference of interests between land owners and local inhabitants. This difference lead to exploitation of coastal ecosystems that benefit only the land owners who do not face the consequences of these actions.

In order to mitigate further degradation of Fijian ecosystems, I recommend to implement sustainable governance with expertise knowledge from multiple disciplines. This way, unexpected processes can be foreseen and preventive actions can be taken beforehand in order to avoid negative consequences. Additionally, ecosystem services should be valued and taken into account when decisions involving these ecosystems are made.

Fiji is already experiencing extensive deterioration of its coastal ecosystems. Many other non-island countries will likely experience similar impacts from climate change on this scale in the following decades. Therefore, Fiji can serve as a warning sign to the rest of the world, to see which actions lead to sustainable growth and which do not.

Chapter Conclusion & Discussion

In the case of Nauru and Fiji, short term economical benefits are strongly preferred over long term planning. There are several reasons for this observed behavior. From the Fiji case, it can be learned that the lack of insight and knowledge of ecosystem dynamics can lead to unexpected processes that deteriorate ecosystems. In Nauru, the high revenues from phosphate exploitation resulted in greed and one thought only: become wealthy as fast as possible. Nauruans did not include long term planning and became trapped in the 'resource curse'. Other economic sections became neglected, and the environment had to pay the full price.

Due to their isolation, small scale and thus limited amount of resources, extensive anthropogenic impacts on islands such as on Nauru heavily deteriorated the ecosystem and altered the carrying capacity of the island. Due to these characteristics, islands like Nauru and Fiji, are very vulnerable to disturbances, as these changes are likely to have an impact on the entire island. Other typical island characteristics are small populations and markets, few skills, expensive transportation and dependency on external services.

In addition, climate change poses a major threat to these islands and their ecosystems. Especially sea level rise, a higher frequency of storms and an increase in temperature affect coastal ecosystems such as mangroves and underwater ecosystems like coral reefs. Positive feedback mechanisms between coral reefs and mangroves even lead to further deterioration of these ecosystems. Due to the usual large coastal area to land content ratio of islands and their location in the Pacific Ocean, which makes them prone to tropical cyclones, Pacific islands are rather vulnerable to climate change.

With respect to the case of Nauru, there are only a few solutions possible to maintain human life on the island. They can continue importing the resources they need, which is highly expensive and causes major dependency. Secondly, Nauru could rehabilitate their ecosystems by importing soils and fertilizers. However, this also requires an extensive amount of financial input. And lastly, there is one dramatic escape: emigration. This is a rather lucky opportunity and privilege compared to the world. Whatever will happen in the next centuries, like a climate that becomes inhospitable to humans, mankind will not be able to abandon this planet and find 'asylum' somewhere else.

Of course, countries on the mainland are less vulnerable to changes due to their vastness and the connectivity and cooperation with other adjacent states. However, climate change, exploitation and deterioration of ecosystems are increasing in scale all around the world. Moreover, anthropogenic influences do not solely affect single locations, but rather affect ecosystems globally as humans can be found worldwide. Yet, as a global society, we do not have the same options as island inhabitants do. We cannot import any resources (as of yet) in the near future, and as it has been mentioned we do not have the option to migrate to other planets. The only solution that remains is to rebuild our ecosystems and live in a sustainable way without worsening the state of our ecosystems. If we keep deteriorating our ecosystems for short term benefits, then we might face the same fate as Fiji and especially Nauru on a greater scale. *"Nauru is not the only one that has dug his own grave, the entire world is doing it"* (Stephen, 2011).

Therefore, Fiji and Nauru serve as warning signs to the world. They see themselves as an example for the rest of society. While a lot of issues are results of practices by foreign stakeholder, former colonists or CO2 emitting countries, Nauru and Fiji are not holding them responsible for the current problems.

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Cuba: an island utopia?

Case studies in Cuba



Plaza de la Revolución, Havana, Cuba.

(Franck Vervial; Flickr)

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Abstract

This chapter consists of four papers about Cuba: “pearl of the Caribbean”, enduring communist regime, self-styled champion of anti-imperial struggle – and island. The first paper (pages 3-8) examines “transculturalism”, examining the interactions between different cultural forms brought by historical processes like colonisation and the slave trade. Paper two (pages 9-15) looks at the relationship between Cuban islandness and Cuban history: how it manifested itself in Cuban politics and how it shaped, militarily, the revolutionary war. Paper three (pages 16-24) examines the changes in agriculture in Cuba over time during periods of considerable isolation. The final paper (pages 25 - 31) again focuses on Cuban history and islandness, arguing for a nissological interpretation of much of Cuban ‘exceptionalism’ as a way of better understanding it. The chapter concludes with a discussion whereby the topics are linked to the contemporary issues of globalisation and the end of the embargo.

Chapter Introduction

Cuba is patently a unique nation: there are a multitude of factors which contribute to this – from its exceptionally long period of Spanish colonialism and slavery, to its ability to successfully foster a Revolution and a communist, Soviet-aligned state in close proximity to the USA, and the ability of that state to outlive the Soviet Bloc itself. Cuba has been subjected to US sanctions and an economic embargo for over 50 years, and this hostility has had profound effects on Cuban political culture and foreign policy, while the forced isolation of this US policy has affected its economy and agriculture. The first paper of the chapter will elaborate on a phenomenon called transculturalism. Transculturalism is a process where two cultures become one, eliminating and combining elements of both cultures. This process occurred in Cuba due to the merging of African and white Cuban cultures, after Spanish imperialism and the slave trade, which lasted more than three centuries and brought around 1.3 million African slaves to the island, bringing with them their own cultures. The paper will try to examine to what extent the slavery era contributed to the transcultural aspects of the contemporary Cuban culture. The second paper focuses on Cuba’s twentieth century history and the decisiveness of its ‘islandness’ in both the political manifestation of capitalist dictator Batista as well as communist revolutionary Castro. Furthermore, both particular manifestations of Cuba constructed particular imageries, which also cannot be separated from and were even amplified by the fact that Cuba is an island. We should study this in relation to Cuba, because it clearly signifies that islands are not isolated worlds set apart from the mainland, but in fact owe their particular political manifestation and especially imagery largely to the mainland they are related to. The third paper examines the changes in main types of agriculture over time. We should focus on this through the prism of Cuba because it clearly represents the rare periods of isolation and the solutions to deal with the constraints there were, making the food system more resilient. When extending the scope, it could become clear which adaptations could secure food production globally in the future. The fourth and final paper looks at Cuba’s “exceptional” history and politics from the perspective of island studies, arguing that nissology has a place in the discipline of History because it helps to explain causation. Cuba’s unique neocolonial experience, Revolution, internationalist foreign policies, and external, diasporic political opposition all make more sense when viewed from this perspective, and Cuba provides a good example for future historians of island societies to follow.

Transculturalism in Cuba: influences from the slavery era

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Slavery is a globally known concept since it is deeply invested in the world's history and multiple cultures. Slave trade began during the era of voyages of discovery led by the Portuguese and the Spanish in the fifteenth century (Rawley & Behrendt, 2005). The slave trade was situated between Europe and West Africa, sometimes passing along Atlantic islands. It was only after the discovery of the New World that the slave trade became transatlantic (Rawley, et al., 2005). As can be seen in figure 1, European traders brought goods to West Africa to trade for slaves, these slaves were shipped to America where slave-manufactured goods were traded and brought to Europe. The slave trade made for international competition. More powers became part of the slave route, all trying to establish a monopoly since the slave trade brought economic growth (Acemoglu, Johnson & Robinson, 2005). This resulted in increasing wealth in Europe.

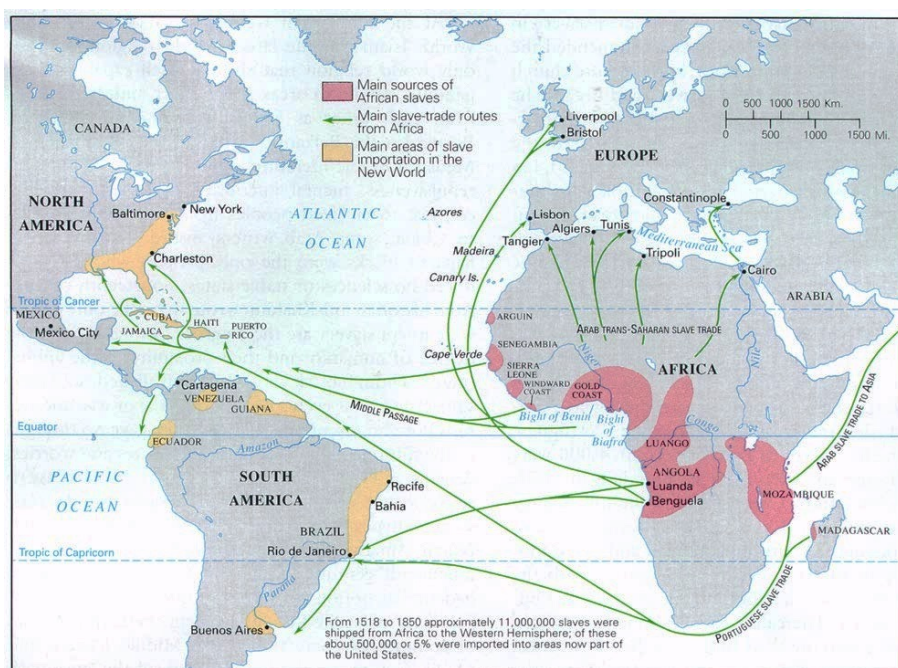


Figure 1. The transatlantic slave route (GeoGarage Blog, 2015)

As Europe's wealth increased, so did the exploitation of the colonized countries, Cuba being one of them. After Columbus discovered Cuba in 1492, Spain claimed Cuba as a colony and Spanish settlements started. In 1512 the Spanish king Ferdinand II authorized slavery (Thomas, 1997). As slave trade increased, the Spanish made sugar and tobacco plantations their main economic objects, increasing Cuban and Spanish wealth (Hunt, 2015). Over a course of three centuries, 1.3 million slaves were brought to Cuba, making up more than fifty per cent of the whole population around the year of abolition, 1886 (Bergad, 2007).

As is argued by Morgan (1997), slavery has the tendency to define the structure of the associated country, or island like Cuba. It does not only affect its economy but also the social and cultural systems. With, in 1886, more than half of the population being Afro-Cuban, African cultures were brought to the country. In comparison to other countries like North America, Afro-Cubans were able to retain their regional cultures in towns (Morgan, 1997). This was possible because Cuba was a fairly urbanized society by New World criteria, in combination with a less controlled existence for urban slaves than slaves in rural areas. As slavery became more persistent in Cuba, more ethnic cultures came in contact with the Cuban culture (Morgan, 1997).

This process can be referred to as transculturalism. Transculturalism is often referred to as the process of *métissage*, mingling of races, that has become a distinctive trait of a culture that is present in the native population and other ethnic groups (Cuccioletta, 2002). According to Ortiz (1965) (cited in Grosu, 2012), transculturalism can be defined as a “synthesis of two phases occurring simultaneously, one being a deculturalization of the past with a *métissage* with the present.”. This means that a new culture, shared by both ethnicities, is based upon the mergence of different people and cultures, making the cultural or national identity not one-dimensional but multilateral (Grosu, 2012). This paper will try to understand to what extent transculturalism occurred in Cuba due to the influence of the slavery era. This will be done using two cases, music and religion, from the African cultures and examine how these are incorporated in the contemporary Cuban culture and by examining the influence of islandness on the transculturalism in Cuba. Using these two cases, conclusions will be drawn in order to answer to following question: “To what extent does the slavery era – 16th to 19th century – contribute to the transcultural aspect of the contemporary Cuban culture?”

African culture surging into Spanish beliefs: transculturalism of Cuba

The following section of this paper will elaborate on two different cases, which are prominent in the contribution to the transcultural aspects of the Cuban culture, namely music and religion. It has been argued by several academics that the Afro-Cuban culture has influenced and contributed to the contemporary culture of Cuba (Valdés-Cruz, 1977). As more slaves came to the country, more ethnicities and regional African cultures were introduced. With a population consisting of more (ex-)slaves than white Cubans, Cubans with Spanish (or European) ancestry, African cultural aspects became, slowly accepted by the white Cubans and their culture. This has predominantly been in the expressive sphere of the Cuban culture like music, literature and religion (Valdés-Cruz, 1977). The first case that will be elaborated on is music whose African influences, play a significant role in the contemporary Cuban culture.

African musical trades in today's Cuban popular music

The slaves traded to Cuba mostly came from West-central Africa, in particular from a region called Yoruba. As slaves were shipped to Cuba for more than three centuries, multiple Yoruban ethnicities were introduced (Morgan, 1997). What happened is called *ethno-genesis*, whereby different ethnicities from the same region formed one ethnic group in Cuba. For generations, slaves from the Yoruba region were included in this group (Morgan, 1997). As mentioned before, Cuba developed more rapidly in comparison to other New World countries, and thus more towns were established in a short period of time. The urban slaves had more latitude in expressing and developing their own culture in comparison to the more disciplined rural slaves. This made it possible for these slaves to retain their ethnic and cultural identity, the feeling of belonging to and identifying with an ethnic group (Morgan, 1997). And thus resulted in certain aspects of their culture to fuse with the white Cuban culture.

Music was one of the most important elements of the African culture that was brought to Cuba. Besides its importance in the African cultures, it also plays a significant role in the contemporary Cuban culture (Benítes-Rojo & Maraniss, 1998). Yoruban, and other African music, was introduced to Cuba when the slaves arrived. In order to practice and retain their cultural beliefs including music, freed slaves and slaves participated in a group called the “*Cabildos de Nación*”. This was a socio-religious and cultural aid organization formed by freed slaves, which tried to conserve the core of the African belief system but also music, languages and instruments (Falota & Childs, 2005). As the organization, the freed slaves, moved through the entire island, more slaves became members and more African traditions were fostered. The “*Cabildos de Nación*” organized festive gatherings with African dances, chants and instruments. The percussion and dances became incorporated into the Cuban national identity later on (Falota et al., 2005). The expansion of the slave trade also made for growth of the “*Cabildos de Nación*” operational sphere. The group gave space to the practices of traditional African culture, while adopting several New World cultural elements.

It is accepted that the modern Cuban music is closely related to African music and percussion. Together with the modernization of the African music, dance and their rhythms were adopted (Valdés-Cruz, 1977). In the first decades of the 20th century Cuba underwent something that one might call a “musical revolution”. During this “musical revolution”, dances and their associated rhythms, all influenced by African music, were popularized. Through the combination of African music and the Spanish musical instruments, like the guitar, new rhythms were created that became globally known like the Son, rumba, mambo and many others. This sort of music was referred to as Cuban popular music, which became a way of expressing the Cuban culture (Cuccioletta, 2002).

From this moment on, the Afro-Cuban music developed through a synthesis of Spanish and black music, denoting a sense of Cubanness (Valdés-Cruz, 1977; Benítez-Rojo et al., 1998). The adaptation of the Son and African music contributed in bringing together the Afro-Cubans and the white Cubans. Benítez-Rojo et al. (1998) argue that this opened a way for cultural components of the Africans to surge, slowly, into the national culture of Cuba, becoming a contributing factor in Cuba’s transculturalism. This resulted in Cuban composers recognizing the African inspired music and incorporate the rhythms into their music. This shows that the incorporation and adaptation of the Afro-Cuban dances, music and instruments into the white Cuban music formed a sense of a common cultural identity, where both African’s and white Cubans could relate.

Besides music, there are also other artistic forms of integration of the Afro-Cuban culture into the common Cuban culture. This integration is prominent in literature. Afro-Cubans and (ex-)slaves were very often protagonists in Cuban literature to serve as a coloured element or were used for social protest (Valdés-Cruz, 1977). During the last decades of slavery in Cuba, more literature was written on anti-slavery and the social circumstances they lived in. Apart from prose literature, also poems were part of the Afro-Cuban culture. Black poets started writing poems in Spanish rhythms and forms. However, later on more interest was shown by white Cubans in poems with African themes and rhythms (Valdés-Cruz, 1977). This again, contributed, through literature, to the Cuban culture of today.

Santeria: African and Catholic beliefs

Slaves who came to Cuba brought with them their own religious beliefs. However, as in most colonized countries, the religion that was practiced was that of the colonial country. In Cuba’s case, Spain enforced a catholic religion onto the slaves (Morgan, 1997). This enforcement of religion extended to the inscription of names into a baptismal book and the obligation of attending mass on Sundays. Through the establishment of the “Cabildos de Nación” the slaves remained able to practice their own beliefs from time to time. These ceremonies made it possible for the African beliefs to survive and to pass them along to other generations (Valdés-Cruz, 1977).

However, religious beliefs are not easily destroyed, even when oppressed. The limited contact slaves had with Catholicism made it possible for the African religions and religious traditions to survive the slavery era (Valdés-Cruz, 1977). As slaves learned more about Catholicism during its enforcement, similarities between African religions and Catholicism were discovered. The similarities were found in the Yoruba and Bantu religions since most slaves came from those regions in Africa (Lefever, 1996). The most dominant similarities were that both religions believed in gods who created and sustained the world, and that there were intermediaries, like priests, standing between the gods and its believers. Also, Africans believed in Orishas, which are similar to Catholic saints (Lefever, 1996). Under the religious oppression, the slaves started to relate different Orishas to Catholic saints and to combine their intermediaries. This eventually lead to a syncretism of African religions and Catholicism, which resulted in a religion known as Santeria, or, the way of saints. Santeria is a fast growing institution that is practiced in both rural and urban areas; in the latter it is often the strongest form of religion. Over the past decades more people have converted to Santeria, both Afro-Cubans and white Cubans (Bascom, 1950). Figure 2 shows the different African religions practiced in Cuba. As can be seen on the figure, Santeria is the most practiced religion together with other

forms within Santería itself. This shows that Santería became part of Afro-Cuban and white Cuban lives after it established itself.

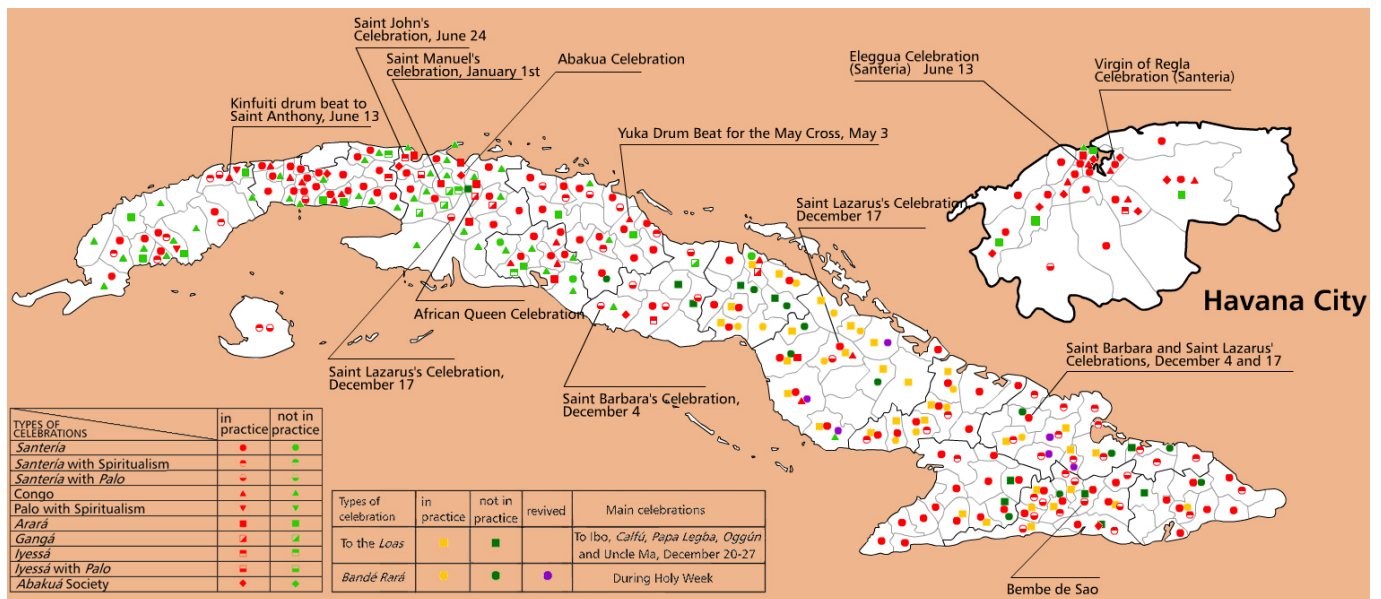


Figure 2, The practice of Santería in Cuba (Gobin & Morel, 2013)

There are several basic rituals and elements present in Santería, which resulted from the syncretism of African religions, spirituality and Catholicism. First of all, the saints and Orishas are similar. With the development of this belief, more Orishas and saints were found similar through their meaning (Lefever, 1996). Additionally, Santería knows three rituals to honour their saints or Orishas. The first one is divination. This is an expressing of the god *Ashe*, also known as the life force of god. It is utilized to deal with daily problems, like money and health. The poor make use of divination to seek advice regarding problems for which counsellors or physicians would help rich people. This ritual is similar to the praying in the Catholic religion (Lefever, 1996). A second ritual is the worshipping of the saints through sacrifices and offerings. This ritual is related to the divination because during divination Orishas, or saints, reveal themselves to help the human in question. In order to thank the Orishas, humans use sacrifices and offerings to express their gratitude and praise that the Orishas continue to do their work (Clark, 2007). Each Orisha has its own type of sacrifice; these can be either food or drinks. After the Orishas have consumed the *Asha* from the sacrifices, the humans are allowed to each and drink. The third ritual used to honour the Orishas is drum and dance festivals, known as *bembe* (Clark, 2007). During these festivals certain rhythms and dances are performed to other specific saints. Again, as with the sacrifices, each Orisha is associated with its own drum rhythm and dance. During these festivals it is believed that the humans who perform will be possessed with the specific Orisha, giving the possessed human advice and warnings (Lefever, 1996).

Through the migration of many Cubans to the United States in the second half of the 20th century, Santería was introduced to other people outside of Cuba. Its diaspora was mostly concentrated in the southern states of the US (Lefever, 1996). Most of the Santería believers came from Cuban exile communities. These white Cuban believers kept on practicing their religion and through time it attracted new people. However, changes are occurring in the Santería belief in the US due to the diaspora. The most dominant is the change in leadership, where, for example, *santeros* (intermediaries) take on more priestly responsibilities than in the Santería of Cuba (Lefever, 1996). Besides the leadership changes, Santería is also undergoing ritualistic changes, through which it gets more syncretized with Puerto Rican spiritism. However, these changes in the US present a paradox: even though Santería is becoming more universal, there is also growing conservatism through the interpretation of rituals in more traditional African manners (Lefever, 1996).

Religion and music are the main cultural elements of the Afro-Cuban culture that have been incorporated into the Cuban national culture. But, besides being two separate elements, Santeria and the music have been combined (Mena, 1998). Afro-Cuban music, also known as popular music in the Cuban culture, has viewed Orishas and saints as one and related to them in their songs. Again, the most prominent elements of the Afro-Cuban culture are incorporated in the Cuban national culture.

Islandness and transculturalism of Cuba

The two examples of synthesis between the Afro-Cuban cultures and the white Cuban beliefs are related to the phenomenon known as transculturalism. Transculturalism does not mean the assimilation of one culture into the other but rather it refers to the transmutations or transculturation of a culture (Ortiz, 1947: 103, cited in Marotta, 2014). The Cuban history, especially as a result of the colonial times, is a perfect example in which transculturation happened in different states of transition. Generally explained, during the colonial era of Cuba cultures came in contact with each other leading to disappearances of some and growth of others. As these transitions took place for several centuries in Cuba, Ortiz (1947: 103, cited in Marotta, 2014) argues that this has resulted in a cultural phenomenon in which the new, contemporary culture is a combination of both cultures however; it will always remain different from either of these two cultures.

Another aspect for the opportunity of a process like transculturalism to happen in Cuba is due to the fact that Cuba is an island, or better said due to its islandness. Islandness, as is argued by Baldacchino (2006), is “an intervening variable that does not determine, but contours and conditions physical and social events in distinct and distinctly relevant ways.” Another significant part of islandness is the isolation posed by being an island that gave the island unique cultural histories (Dodds & Royle, 2013). Cuba’s colonial history could be addressed as a form of islandness. During colonial times slaves in the Caribbean suffered from social and political oppressions, however due to the isolation of the islands, and their islandness, these oppressions affected each island and their cultural uniqueness differently. Cuba, and Puerto Rico, were often said to be too isolated in order to establish a common identity like the other islands of that region (Clarke, 1976). Their isolation from the influence of other cultures, besides the ones brought in through slavery, contributed to the transcultural process and in containing it. In other words, Cuba’s unique and persistent culture, which emerged through transculturation of African cultures and white Cuban beliefs, is conditioned by the islandness of Cuba and through the isolation from outside forces.

Conclusion: transculturalism emerged due to influences of African cultures introduced in the slavery era of Cuba.

This paper tried to elaborate on the process of transculturalism. Transculturalism is a process where two cultures merge together. In doing so, both give up certain elements of their culture and combine others. This means that a new culture is formed, different from the others, to which both ethnicities can relate and identify themselves with. This paper elaborated on transculturalism using Cuba as a focus point. Cuba endured slavery for more than three centuries; during this period 1.3 million slaves were brought to Cuba. The coming of these slaves resulted in the introduction of African cultures in a country owned by Europeans. This paper examined two elements in the contemporary culture in which the African culture influenced most, namely music and religion. Using these examples this paper tried to examine the extent of the slavery era contributed to the transcultural aspect of the contemporary Cuban culture.

Cuban popular music is one of the results of transculturation of the Cuban culture. As African cultures came to Cuba they brought with them their musical instruments, dances and rhythms. In the first decades of the 20th century this led to what some call the “musical revolution” of Cuba. During this period, African and Spanish music, rhythm and dances were combined and created new forms of music like the Rumba, Mambo and the Son. These rhythms and dances became internationally known and were referred to as Cuban popular music, which became a way of expressing the Cuban culture denoting a sense of Cubanness. The adaptation of the African culture in the musical scene of Cuba contributed in bringing together the afro-

Cubans and the white Cubans. It was argued that this opened a way for the African culture to surge into the national culture of Cuba forming a sense of common cultural identity and thus contributing to its transculturalism.

Also religion played a significant role in the transcultural aspect of the Cuban culture. During the slavery era slaves were forced to practice Catholicism, resulting in them finding similarities with their own saints and gods. The slaves began to relate their saints, Orishas, to those of the Catholic belief and combining their intermediaries like priests. This led to the syncretism of African religions and Catholicism, resulting in the creation of a new religion, Santeria or the way of the saints. The religion incorporated ceremonies, festivities and rituals from both cultures in it, increasing its popularity for both Afro-Cubans and white Cubans. Even today, Santeria remains a religion that is practiced increasingly in Cuba and has spread to parts of the USA.

Music and religion are both very important elements within the Cuban culture and shows that transculturalism has occurred and developed through the contact with African cultures introduced during the slavery era. The fact that Cuba is an island, or rather its islandness, has contributed to the possibility of Cuba having a transcultural culture and to the containment of the transcultural aspect of the Cuban culture with as little as possible intrusion from other cultures and ethnicities. Thus, these examples, music and religion, show that slavery has played a significant role in the process of transculturation of Cuba and to the contemporary Cuban culture.

Cuba: Paradise of Pleasure ánd Communist Utopia?

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Figure 1

Walking through the streets of Havana one feels that one is thrown back in time for more than half a century. Buildings date back at least to the 1950s and the majority even from around the turn of the century when the Spaniards were still ruling this island. For children of the modern age, the immense and curvy American Chevrolets, Cadillacs and Fords give the feeling of having ended up in a film entitled *Back to the Past*. Nostalgia for a long-gone era for the Western world takes hold of the visiting tourist.

But the walls that have been holding back modernization from Cuba appear to crumble and the twenty-first century seems to finally descend upon the Communist-ruled island. On 17 December 2014 Obama gave a historic address on the renew of Cuba-US relations:

“Today, the United States of America is changing its relationship with the people of Cuba. In the most significant changes in our policy in more than fifty years, we will end an outdated approach that, for decades, has failed to advance our interests, [...] I believe that we can do more to support the Cuban people and promote our values through engagement. After all, these 50 years have shown that isolation has not worked. It’s time for a new approach.”¹

Towards the end of his presidency President Obama has led a thaw in US-Cuban relationships, instigating the normalization of diplomatic relations and allowing the flow of people, ideas, the Internet and investments to take place.² And the historic development seems to move fast towards the lifting of the embargo on the Caribbean island nation. The White House seems dedicated to open up to Cuba to empower Cubans to build an open and democratic country, and, not in the last place, to open the market to its business.³ And this new policy appears to be not just a one-off case, but an event in a perhaps larger development in US foreign policy. As the two important US ambassadors William Luers and Thomas Pickering argue, the Cuban example is perhaps a first sign of a new era in American diplomacy.⁴

The future, however, obviously is not all peaches and cream. Already well before the true lifting of the embargo, Cuba is being flooded with millions of tourists trying to get a glimpse of the abovementioned nostalgic world of (pre-)revolutionary Cuba. The question quickly arises how Cuba can cope with this explosion of tourism. Not only does it have to handle bigger amounts of tourists than the existing tourist infrastructure

¹ Barack Obama, <https://www.whitehouse.gov/the-press-office/2014/12/17/statement-president-cuba-policy-changes>, retrieved 16 December 2015.

² Gabriella Marcella, ‘The right to be honest’, The Huffington Post, http://www.huffingtonpost.com/gabriel-marcella/the-right-to-be-honest_b_6555054.html, retrieved 16 December 2015.

³ John Kerry, <https://www.whitehouse.gov/issues/foreign-policy/cuba>, retrieved 16 December 2015.

⁴ William Luers, Thomas Pickering, ‘Cuba and Iran: A New Era in American Diplomacy?’, *The Huffington Post*, 20 January 2015, http://www.huffingtonpost.com/william-luers/cuba-and-iran-a-new-era-f_b_6508150.html, retrieved 16 December 2015.

can handle, but it also has to deal with the fear of the loss of Cuban identity with the preeminent “Americanization” of a country’s identity which in the twentieth century has been partly built on being the anti-pode of Americanism.⁵ Evidently, governance, the form of government and the international relations of a country are fundamental for an island’s development, state of being and the daily lives of its inhabitants.

No matter what consequences, the idea remains that this change to policy held up for five decades is historic. But why were the relations severed in the first place? And to what extent has the ‘islandness’ of Cuba influenced the course of the tumultuous Cuban history of the twentieth century?

In this paper, the latter question stands at the center. First I will elaborate upon the attractiveness of Cuba as an island, going into the projections of exoticism. Then I go into the US-backed Batista regime in the two decades preceding the Cuban Revolution, in which the island, thanks to Batista and his involvement in the American mafia, appear to be transformed into a casino resort and brothel for Americans to do the things they were not allowed to do in the US.⁶ After this I am going to examine the Cuban Revolution and especially the role the ‘islandness’ of Cuba played. Finally, on the basis of the analysis, I try to form a conclusion.

Projections of exoticism

Cuba’s ‘islandness’ has played a key role in its popularity as a holiday destination of indulgence, for by being an island projections of a utopian world could be projected upon the world set apart from the mainland. The image that was formed of Cuba as an exotic idealized world of seduction and lush paradise was a major contributor to its tourist appeal.

The US’ interest in the island of Cuba dates as far back as 1821 when founding father Thomas Jefferson wrote to President Monroe that “*I have ever looked on Cuba as the most interesting addition which could ever be made to our system of states.*”⁷, after the US had taken control of the Florida peninsula. There was an idea in the US that Cuba was a ripening fruit that in its natural course would eventually belong to the US.⁸ Its affinity with the Caribbean island would, however, evolve into a mafia built seaside gambling resort which in profits and glamour was far from inferior to its sister project Las Vegas. As one US army veteran on holiday in Havana declared, “*We gave Cuba her liberty and now we are going to enjoy it.*”⁹ With the Prohibition of 1919 the sunny tropical island with infinite beaches with unequalled blue seas right at the US’ doorstep became the escape for Americans – and men in particular – to indulge in legal booze.¹⁰ But with the tourists came prostitution, and Cuba very rapidly grew the reputation for being ‘*The Brothel of the New World*’.¹¹



Figure 2

From the 1920s until the US-embargo instigated by the Cuban Revolution Cuba was an immensely popular tourist destination. This development did however not just occur because of Cuba’s geographic location and the influx of mafia money. A major contributor to the popularity of Cuba as a holiday destination of indulgence, was the image that was formed of Cuba, projecting an exotic idealized world of seduction

⁵ Tyler Wetherall, <http://www.theguardian.com/travel/2015/oct/30/travel-to-cuba-increases-us-trade-embargo>, retrieved 16 December 2015.

⁶ Joshua Jelly-Schapiro, ‘An Empire of Vice’, *The Nation*, vol. 288, 29 June 2009, pp. 23-31.

⁷ Idem, p. 23.

⁸ Idem, p. 24.

⁹ Idem, p. 25.

¹⁰ Idem, p. 26.

¹¹ Idem, p. 26.

and lush paradise. There were brothels all over the US but Cuba seemed to have earned this reputation because of the image formation: *"The island was like a woman in love, eager to give pleasure, she will be anything you want her to be."*¹² Its sensuous Caribbean, Latino and African music, dances, rhythms and food contributed to the idea of Cuba as an exotic place far from the world of the middle class US citizens. An example of this is a slogan of a black bean dip brand: *"Waving palms, a cool island breeze, visit a forbidden paradise of silky black beans sweet red pepper, and an undercurrent of rich old rum, resulting in a Cuban sensation that may taste mild, but is definitely hot, hot, hot!"*¹³

Cuba, then, was exoticized and eroticized, and projections of the island as a tolerant realm of debauchery contributed immensely to its popularity. Examples of the exoticizing of Cuba and the exploitation by the tourist industry can be seen on figures 2 and 3 where different settings of the famous Tropicana night club are shown. Americans were allured by romantic visions of a 'hedonistic' island paradise in the Caribbean Sea. An example of these idealized projections on the island of Cuba and its inhabitants as something exotic and lush gives Enrique Cirules stating in the chapter 'Rumba Heaven!' in his book *The Mafia in Havana: "The island was the paradise of the rumba dancer, the maraca and rum."*¹⁴ In *Tropicana Nights* another author alluringly describes the shape of the island as a crocodile and a sensuous woman *"lithe yet curvaceous kneeling and arched backward."*¹⁵ Further on in the book one of the interviewees states that *"The defining feature of a Cuban [...] is a person who will do just about anything to get a minute of pleasure."*¹⁶ Likewise, in *Bohemia* magazine, somebody in 1957 states that *"Cuba [...] had been converted into the country of surprises [...] Miracles abounded. [...] because this island was the country of great surprises."*¹⁷ Cuba is here represented as an island full of surprises, outside of the 'real' world, as a fantasy world entirely on its own. The image of Cuba that American tourists were falling in love with were beginning to become very unlike the real Cuba. Nonetheless, the exotic and shiny image of Cuba persisted and was popularized by the grand casinos of Havana, the gaudy floor shows of the Tropicana night club and the succession of Cuban dance craze hits in America: the rumba, conga, cha-cha-chá, and mambo.¹⁸

The projection of romanticized worlds is not just confined to the island of Cuba. As Prof. Dr. Henk van der Vliet pointed out, in the known past islands have always been used to project both horrifying hellish worlds and heavenly places on earth.¹⁹ Islands are a world set apart from the mainland and are thus ideal to project other worlds, either desired or detested. Likewise, Isleifsson points out that images of islands are created that are the exact opposite of the way of life of the country in which these images come into being.²⁰ The US in this period is rapidly becoming the world's industrial, economic and technological hegemonic power. Against this backdrop of productivity, idealized projections and fantasies on the island of Cuba as the paradise of pleasure appear to have come into being.

'Islandness' in the Cuban Revolution of 1959

In the predawn hours of New Year's day 1959, dictator Fulgencio Batista anxiously embarked his plane and went into exile on the neighboring island of Hispaniola on the Dominican Republic's territory. Batista's US-supported dictatorial regime was driven off the island by the guerilla war led by Fidel Castro, his brother

¹² Joshua Jelly-Schapiro, 'An Empire of Vice', *The Nation*, vol. 288, 29 June 2009, p. 26.

¹³ Idem, p. 26.

¹⁴ Enrique Cirule, translated by Douglas LaPrade, *The Mafia in Havana: A Caribbean Mob Story* (Melbourne, 2004), p. 8.

¹⁵ Ofelia Fox, Rosa Lowinger, *Tropicana Night: The Life and Times of the Legendary Cuban Nightclub* (Orlando, 2005), p. 24.

¹⁶ Idem, p. 33.

¹⁷ Author anonymous, *Bohemia* magazine, "En Cuba" section, Havana, September 8, 1957, cited in Enrique Cirule, translated by Douglas LaPrade, *The Mafia in Havana: A Caribbean Mob Story* (Melbourne, 2004), p. 11.

¹⁸ Paul Dosal, *Cuba Libre: A Brief History of Cuba* (Wheeling, IL, 2006), p. 74.

¹⁹ Henk van der Vliet, 'Representations of islands (Scandinavian Islands as case study)', lecture on 2 December 2015, University of Amsterdam.

²⁰ S.R. Isleifsson (2011). 'Islands on the edge.' In S.R. Isleifsson (Ed.) *Iceland and Images of the North*, Presses de l'Université du Québec: Québec, pp. 59.

Raúl and 'Che' Ernesto Guevara, who subsequently installed a Communist government. The Revolution signified the end of the island's prevailing image as the 'Empire of Vice' dominated by the entertainment seeking American tourists. The island, instead, quickly and powerfully took on the image and became the symbol of the worldwide anticolonial and revolutionary ferment following World War II.²¹ Castro's and Guevara's energetic, passionate and ideological resistance against the 'imperialists' from the US was a great inspiration to the youthful New Left emerging in Europe. For the Soviet Union the Cuban Revolution also gave hope for and revitalized the idea of communism in the post-Stalinist era.²² Important to note is also that in the islands previous function as a projection screen for 'hedonistic' tourists, Cuba developed as the 'Las Vegas of the Caribbean' and all its Mafioso gaudiness and inequality paved the way for the revolutionary anti-imperialist, communist sentiment to take root on the island upon which Castro's guerilla war and subsequent government flourished.²³

The islands function as a projection screen for many of the worlds hopes, dreams and fantasies was not the only element influenced by Cuba's 'islandness'. Being an island has strategically played an important role in the bringing about of the Cuban Revolution of 1959, which on paper beforehand appeared doomed to failure.

In the general amnesty of May 1955, without foreseeing the tumultuous future, General Batista released, amongst others, Fidel Castro from prison. Castro refuses to renounce his right to insurrection, proclaiming himself a disciple of the 19th century Cuban revolutionary José Martí stating: "*The hour has come to take rights and not to beg for them.*"²⁴

In the initial phase the fact that Cuba is an island did not work to the revolutionaries' advantage. Two days behind schedule with the yacht *Granma*, they landed in the mangrove forests, trying to cut their way through the dense bushes and tropical forests. Numerically they absolutely start out inferior to the well armed, well trained, US-backed 40,000 troops of Batista. Nonetheless, the 20 or so members of the *Movimiento 26 de Julio* as the revolutionaries call themselves, take refuge in the Sierra Nevada mountains and from there launch their incessant guerilla warfare on the army. Batista underestimates the revolutionaries, loses support of the US government after inflicting atrocities on its civilians and has to deal with a low and diminishing morale amongst his troops.²⁵ The young revolutionaries on the other hand, make great progress, gaining popular support amongst the peasants and gain territory.

Because of the island geography of Cuba, a decisive development in the war is able to take place. In late August 1958 Che Guevara, Camilo Cienfuegos and their troops make a strategic though risky military move and march across the island, thus splitting it in two, cutting off supplies and reinforcements of Batista's Oriente Province and dividing his forces.²⁶ At the end of 1958 the Revolutionary army is rapidly advancing towards Havana, Batista's stronghold, and thus victory. Again, because Cuba is an island hence surrounded by water, Batista is driven into a corner, unable to retreat and regroup, and thus with imminent defeat is forced to accept his overthrow, completely abandoning Cuba and fleeing the island, going into exile in the Dominican Republic.²⁷

Especially considering the historical context of the Cold War and the struggle between the capitalist and communist blocs for increasing their sphere of influence worldwide, the victory of the rebel army comes as a major blow to the US. After more than half a century of American interference and dominance in Cuba,

²¹ Barry Carr, Aviva Chomsky, Pamela Maria Smorkaloff, *The Cuba Reader: History, Culture, Politics* (Durham and London, 2003), p. 333.

²² Idem, p. 333.

²³ Samuel Farber, *The Origins of the Cuban Revolution Reconsidered* (Chapel Hill, 2006), pp. 26-7, 32-3.

²⁴ Paul Dosal, *Cuba Libre: A Brief History a Cuba* (Wheeling, IL, 2006), p. 76.

²⁵ Idem, pp. 79-82.

²⁶ Paul Dosal, *Cuba Libre: A Brief History a Cuba* (Wheeling, IL, 2006), p. 81.

²⁷ Idem, p. 82.

the US see the transition of its 'hedonistic playground' island from its own sphere of influence to that of the inimical communist camp.²⁸ Henceforth, the US try to retake control of the largest island of the Caribbean by a CIA designed covert operation via backing up a "quiet" invasion at the Bay of Pigs. 1,500 Cuban counterrevolutionary insurgents try to invade the island, but after merely 48 hours they are defeated by Castro's Rebel Army, capturing 1,186 men, killing 107 and losing only 161.²⁹ Yet again, the island geography plays a crucial role for Cuba's course of history, for it is thanks to the natural defense of the surrounding water of the island that the US backed counterrevolutionary forces have an enormous hard time invading the island and conquering even the slightest bit of Cuban territory.

Militarily, then, Cuba's 'islandness' has definitely worked in the current government's advantage. But being an island has for Cuba not only been significant in politico-military strategic affairs. As mentioned earlier, in the image formation of Revolutionary Cuba the 'islandness' appears to again have played a considerable role. This time the island was not pivotal anymore as the imagery of the 'Empire of Vice', but as the poster child of the revitalized dream of the Communist Utopia for communists worldwide. On figure 4 Che Guevara with in the background the flag of Cuba and the caption 'Cuba' can be seen. This figure is representative for the iconography of the independence struggles worldwide. For the Soviet Union it proved that their utopian project was alive and kicking, and Che Guevara became the billboard image for anticolonial, anti-imperialist struggles worldwide. The Cuban socialist experiment was not only going to transform politics, economics, and society, but also they would seek to create a "new man".³⁰



Figure 4

The Cuban Revolution, then, turned the island into a projection screen for the Communist utopia to be fantastically screened upon for the new anti-imperialist, antiracist dynamic that grew throughout the newly defined Third World, such as Angola, Nicaragua, Venezuela and Bolivia.³¹ The island of Cuba once more became a world upon which idealized worlds were projected and it symbolized the need for peoples from the Third World to escape from under the imperialist American yoke.³² That these romanticized images and projections proved rather fictitious seems clear. The traditional colonial dependence that the Revolutionaries sought and thought to have escaped, was again reproduced with the Soviet Union and again the monoculture agrarian economy, heavily reliant on the world prices of sugar. From 1959 to 1989 the Cuban society and economy deteriorated and the continuous governments repression stands in stark contrast to the socialist ideals it purports to aspire to. Moreover, ever since the fall of the Soviet Union, the island has seen an accelerated deterioration of its economy.³³

²⁸ Idem, p. 45.

²⁹ Idem, pp. 91-3.

³⁰ Barry Carr, Aviva Chomsky, Pamela Maria Smorkaloff, *The Cuba Reader: History, Culture, Politics* (Durham and London, 2003), p. 333.

³¹ Idem, p. 333.

³² Barry Carr, Aviva Chomsky, Pamela Maria Smorkaloff, *The Cuba Reader: History, Culture, Politics* (Durham and London, 2003), p. 333.

³³ Idem, pp. 515-6.

Nonetheless, it's not all gloom and doom in Cuba. The country has one of the highest Inequality-adjusted Human Development Index scores of Latin America, overall scoring higher than Costa Rica and Brazil, and a higher life expectancy than the US and Denmark.³⁴ With the normalization of relations with the US and the pending lifting of the US embargo, it is likely that the situation in Cuba will further improve. Trading with the biggest economy in the world will dramatically increase, boosting the ailing Cuban economy. The influx of American tourists will furthermore bring in the necessary funds. Current egalitarian education, healthcare and social policies can be protected and thus persisted if the current Cuban government manages to uphold against the impending 'Americanization' of the island. And perhaps then, the future boost to the economy will lead to a further rise in the Inequality-adjusted Human Development Index.

Conclusion

Cuba's 'islandness' in its twentieth century history has played a decisive role in multiple ways. Ever since founding father Thomas Jefferson expressed the US' interest in Cuba, there has been an intricate love-hate relationship between the two countries. During dictator Batista's reign Cuba was the utopian world of pleasure and seduction. It was 'The brothel of the New World' and against the backdrop of one of the most productive periods in the history of the US, idealized projections of a tropical island paradise where all fantasies could be lived out, came into being and allured millions of American tourists. On the onset of 1959, the year of the Cuban Revolution, the imagery of this world set apart from the mainland changed entirely. After the rise of the Communist revolutionaries Cuba became the poster child of anti-imperialist, anticolonial struggles worldwide, and the revitalized Communist dream. Being an island made Cuba again the ideal projection screen for these utopian worlds. But not only in the imagery did Cuba's 'islandness' play a very influential role. Military strategically the island geography made it possible to cut off the troops on Batista's eastern flank from supplies, thus able to defeat the US-backed Batista troops which on paper were far superior to the revolutionary guerilla troops. Batista was driven into a corner and unable to retreat thanks to the surrounding water, had to abandon the island entirely.

On the surface, then, a straightforward nuclear standoff of power politics between the two super powers, the US and the USSR in the Cold War climate, appeared to have caused the US embargo on Cuba. However, as more often than not is the case, deeper complexities lurk beneath the surface. As this paper has attempted to show, Cuba's 'islandness' has influenced its twentieth century history dramatically. Hence, it could be said that it is partly responsible for the US embargo that has isolated it further still. Put differently: Cuba's 'islandness' has made it more of an island during the course of the twentieth century. However, the question can be raised on how long this increase in 'islandness' can uphold in the ever more globalizing twenty-first century and the aforementioned developments in Cuban-US relations.

³⁴ UN Human Development Report, <http://www.theguardian.com/global-development/datablog/2010/nov/04/human-development-index-equality-matters>, retrieved 18 December 2015.

The change in Cuban Agriculture: a change for the world?

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Introduction

Fernando Funes Monzote is a farmer and researcher in Cuba, who tries to obtain a high yield with low use of extern or oil based products. Funes is growing crops in a permaculture, combining different crops and livestock on the same land to make better use of nutrients and water. In conventional farming 5 kilocalories are needed to produce 1 kilocalorie of a certain product, whereas in his kind of farming, which makes use of the biodiversity, 1 kilocalorie of input is needed to produce 5 kilocalories of a product. As such, and according to his own calculations, permaculture is 25 times more efficient than conventional agriculture, although more human labor is needed. The farmer and researcher states that Cuba could become self-sufficient when using this agriculture farming-model (BBC,2009).Cuban agriculture has gone through many stages, as a result of Cuba doing so. Since the birth of the socialist state Cuba in 1959, progress of the island was the main goal. Development of rural infrastructure, education and health programs, stimulating better working and living conditions created community welfare, but also lead to unforeseen negative side-effects. Those side-effects include environmental degradation, such as soil degradation, water pollution, deforestation and strong dependence on extern imports as goods and technology (Feblez-González, 2011).

The change in Cuban agriculture also started in 1959, when the Agricultural Reform Law was passed. This law caused the island its economy to become more and more dependent on the agro-industry. As a matter of fact, Cuba had the most mechanized agricultural sector in Latin America in the eighties. According to Wright (2014) Cuba even had more tractors per hectare than the United States of America. The island became heavily dependent on the import of materials. In 1989 the Sovjet-Union fell and the United States intensified the economic blockade in relation to trade with Cuba. Half of diesel imports and 75% of petrol, agrochemicals and animal feeds imports were affected. As a consequence, the agriculture was affected extremely negatively. Total domestic food production decreased with 35% and the seed production decreased with 50%. Alternative ways of producing food had to be found, which lead to the developing of different forms of agriculture like the permaculture on Funes' farm, fitting into agro-ecology and sustainable agriculture (Feblez-González, 2011; Wright, 2011; Funes, 2002; Nelson, 2009).

In this report, the main goal is to provide knowledge about the key changes in the agriculture and soil health of Cuba from 1984-2016, because this period includes the most important era's and the present state. Also, this research will be taken into broader perspectives: Could the world learn from this –partial-solution to the Cuban food problem? First of all, the Cuban agriculture era's are described in a chronological way. Then, the agro-system of Cuba, the way the system changed and its socio-ecological resilience will be discussed. Following, the islandness of Cuba and its influences are discussed and the results are taken into broader perspectives. Finally a short conclusion will be presented.

Agricultural eras

Together with the changes in social and economic policy, the agriculture of Cuba has been changing the past 35 years. The key changes which have been taking place are divided in three small time areas: *Green Revolution*, the *Special Period* and the *Reanimation of the Economy*.

The Green Revolution 1984-1991

The Green Revolution, also known as the “Soviet Agricultural Revolution” lasted from 1984 till 1991. The main goal in this revolution was to maximize profit by reducing costs and labor and increasing productive capacity (Nelson et al., 2009). The increase of profit is realized by opening new farmland, creating monocultures, the import of agricultural chemicals, a wide use of various hybrids and machinery and the import of oil. The Cuban economy became completely dependent on sugarcane exports, and the ecosystems have been seriously affected in the period.

Three quarters of the total arable land were state farms at the begin of the period, which caused farmers to be separated from their land and the degradation of farmers to agricultural workers. Traditional agriculture changed in modern agriculture; the government invested 30% of the total national investments in agricultural machinery. As such, the use of oxes was seriously reduced. Only the tobacco crops grown on the Vuelta Abajo Plains were still depending on traditional technologies and cultivated with animals (Febles-González, 2011). As a consequence, a lot of traditional and ancestral knowledge got lost and the migration to urban areas increased (Febles-González, 2011).

The major part of agriculture existed as large scale agriculture, based on oil and agrochemicals. Close to 100% of all fertilizers, herbicides and animal feeds were imported, and Cuban farmers were fertilizing the soil twice as much as the farmers in the United States did (FAO, 1986). The extensive farming and over-exploitation of the soil caused soil organic matter content loss, environmental pollution and the reduction of water permeability. The damaging of ecosystems resulted in more and more dependence on chemical imports, while natural fertility and productivity were decreasing. The lack of a national agricultural extension system, resulted in little communication between farmers and scientific centers, a stop of innovation and lack of understanding of problems on both sides (Febles-González, 2011). Environmental nor production problems could be solved, overall, the problems only got worse by using more chemicals.

Funes (2002) argues that the Cuban people were put at a great risk by Fidel Castro, creating those policies. Most of the previously mentioned exports relied on the socialistic countries in Eastern Europe and the Soviet Union. On top of that, also a large percentage of the food security was provided by those counties (for example 78% of cereal consumption was imported). Eastern Europe started to abandon socialism in 1989, which resulted in the disintegration of the Soviet Union in 1991 (Funes, 2002).

The Special Period 1991-1996

In 'The Special Period', which lasted from 1991 till 1996, Cuba had to deal with the consequences of the fall of the socialist block. The government could not depend on the assistance and trade with the Soviet Union anymore. The export market did not exist any longer, so Cuba also could not pay for imports anymore, most of them relating to agriculture and food.

Funes (2002) indicates that the food imports were halved after 1988 (Figure 1), and the undernourished part of the population increased from <5% to 20% of the total population. In this period, food, fertilizers, pesticides and oil became scarcer. For example: the availability of fertilizers decreased with 80% after 1989. Petrol, other agrochemicals and animal feeds availability decreased with 75% and diesel availability was cut in half. Farmers had to exist more independently of the import of supplies for their agricultural lands.

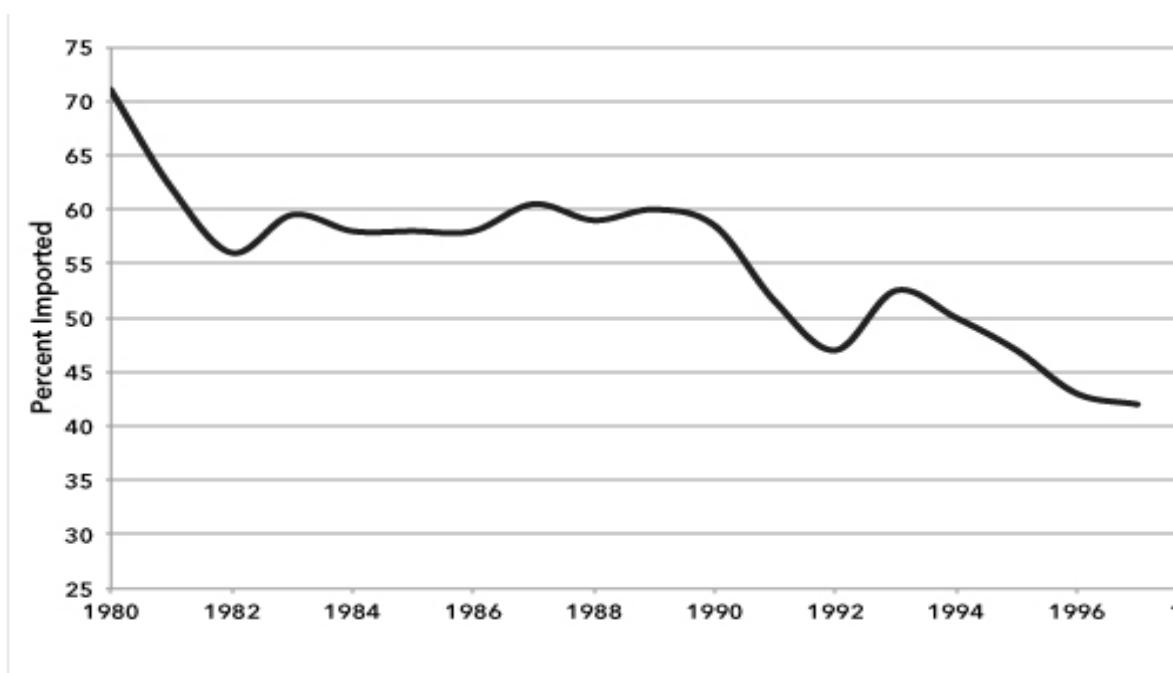
The shortages in resources caused the Ministry of Agriculture to develop an “Alternative Model” for agriculture in the 1990’s, which is based on replacing of machinery by oxes, reducing reliance on pesticides, supporting new research and development on sustainable techniques, provisioning agroecological training, encouraging cooperation amongst farmers and trying to halt urbanisation (Nelson et al. 2009). Policies were designed to realize those goals, such as the splitting of large farms into smaller ones and the development

of biocontrol products. Not just the government, but also NGO's have supported this redevelopment of Cuban agroecology (Nelson et al., 2009).

These policies led to overall diversification of farming and to a partly more environmentally friendly food production (Febles-González, 2011; Wright, 2014). Different forms of agriculture, like permaculture and small scale urban-agriculture, were being developed to compensate the loss of imports (Wright, 2014). These measures lead to the recovering of food production to a certain extent, in which Cuba succeed as the only country in the world (Altieri and Funes-Monzote, 2012).

State farms were reduced significantly, from 75% to 33%. The major part of the state farms were divided between collective farms, which were organised more democratically (Funes, 2002). Overall, the farms were existing on a smaller scale, and the economic circumstances of the workers were dependent of the farm its performance.

Despite the agricultural changes in the Special Period, agricultural production decreased with 35%, and food intake in 1997 (2480 kCal/capita) was less than in the eighties (3125 kCal/capita) (Funes, 2002). The domestic production did not increase, but the imports decreased. Because the decrease in imports, the Cubans were considered to be more self-relying, but in fact, the consumption per capita decreased and still 45% of the calories per capita were dependent on the cereal import (Johnson, D.G, 2003). However, the loss from the enormous decrease in production of the state farms was still somehow being compensated by the new measures in this period.



Source: José Alvarez, *The Issue of Food Security in Cuba*, University of Florida report FE483, downloaded July 20, 2011 from <http://edis.ifas.ufl.edu/pdf/FE/FE48300.pdf>.

Figure 1: Cuba Food Import Dependency, 1980-1997 (Altieri, 2012)

The Reanimation of the Economy 1996-2007-now

Despite the changes in agriculture programs, the Cuban agriculture was not satisfying the needs of the population at all. The government had been stimulating agricultural practices and rural services for years, but in 2007 only half of the arable fertile land was in use and the amount people working in agriculture decreased by almost 20%. The main goal in this period was to change this trend and promote rural employment by promoting relations between city and country. Besides, there was also a focus on improving productivity technologies and the access to and exchange of knowledge was being increased (Febles-González, 2011).

Ancestral knowledge and conservation of the ecosystem services are playing a prominent role in the current agricultural programs. However, importing food is becoming more and more important in this period, which is leading to a greater dependency and vulnerability. But, overall changes in ownership by introducing private markets and distribution of state agricultural land into smaller farms lead to a more sustainable way of farming and more food security. Funes (2008) concludes Cuban agri-ecology could, despite the land degradation and previous loss of ecosystem services, provide enough calories to feed its 11 million inhabitants.

Farming in the present

As written in the previous chapter, the Cuban people have gone through many changes and difficulties in food security. In the Special Period, partial solutions have been made up, which would continue to develop over time. In this chapter, the present status of two of the recognizable solutions are evaluated. Besides, a clear vision on the process of the changing is given.

(Peri-)Urban farming

The government has been supporting growing food in the cities in the past. The knowledge spread quickly, but urban agriculture has its constraints, because of lack of space and deep soil. In Havana, 80% of total consumed lettuce is grown, but staple foods, which are most important, cannot be grown in the tight city (Wright, 2014).

However, 70% of the necessary food can be grown in a 40 km radius around the cities. In this *peri-urban production* mostly organic pesticides and fertilisers are used. The farming is considered reasonably sustainable by Wright (2014). The FAO (2012) states that the stagnation in food prices have proven the importance of urban and peri-urban agriculture. The form of agriculture not only secures the availability of food, but it also realizes employment for the poor, contributes to national development and a more pleasant urban environment. Moreover, the FAO (2012) states that Cuba developed a successful (peri-)urban agriculture program in two decades, meeting 'a large part' of urban food demand. According to the FAO (2012) Cuba is now implementing a peri-urban program, expanding the urban agriculture in the country.

It can be concluded that the use of (peri-) urban agriculture has been recognized to improve food security and that it stimulates balanced development by the FAO (2012) and Wright (2014). The use of (peri-)urban agriculture in other parts of the world will be evaluated in the 'Islandness' section.

Rural farming

Despite the import constraints due to the fall of the socialist block and the measures of the United States, *state-prioritised monocultures* are still covering 30% of the total agriculture. However, the performance of this intensive agriculture fell during the years, because of the extensive use and lack of insight in ecosystem services (which are being evaluated in the 'Resilience' section).

A large part of the small farming systems, appearing after the division of the previous monocultures during the 'Special Period' are still using chemicals nowadays. In these farms, self-sufficient *low-external-input systems* were used. The farmers were told to diversify and try to feed the people as much as possible. There has been a lack of stimulation from the governance to change the agriculture, as it was said next year the problems were solved. The government was hoping for an increase in imports and agricultural inputs, and was focusing on quantity of food. In these systems, farmers, had to become self-sufficient. However, the low-input system is not organic (Warwick, 1999; Wright, 2014; Pretty, 1995).

On the other side, with help of NGO's and the farmer-to-farmer word spreading, *intentional eco-projects* were established. The sustainable farms represent 30% of the total agriculture, but are often considered to be the leading method of performing agriculture. In this agriculture, oxen and integrated pesticide managements were used more often. Also crop rotation, organic fertilizers and soil conservation were used. Those methods combined resulted in an increasing yield, differently than the continuing state agriculture (Wright, 2014; Warwick, 1999; Pretty, 1995).

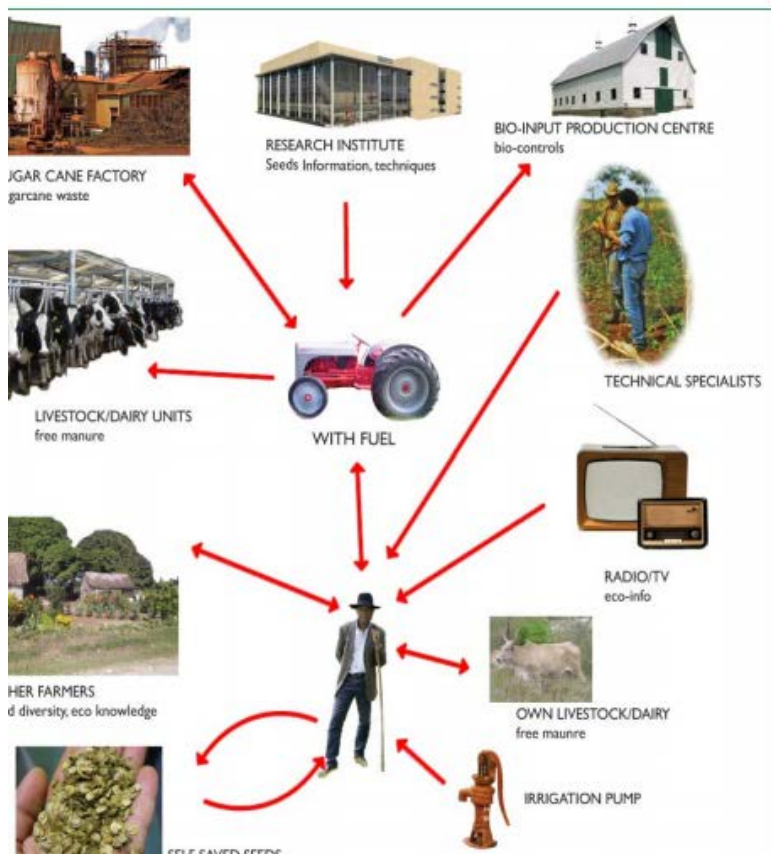
The agro-system

Because Cuba is an island, import can be seen as an external system input. Therefore, it is easier to get an overview of the system. In this part, small farming systems with or without fuel are discussed to obtain insight in the farmers' situation of the past and present. After this, the resilience of the agricultural system is investigated. Finally, the relation between the topic and the 'islandness' are discussed.

The fuel cut

The fuel cut in Cuba resulted in an enormous change in the agricultural system in Cuba, as represented in Figure 2. The farmers with access to fuel are able to travel by car, and therefore they are able to exchange scientific knowledge about cropping with the research institute, they are able to obtain fertilizers and

Farmers with access to fuel



Farmers without access to fuel

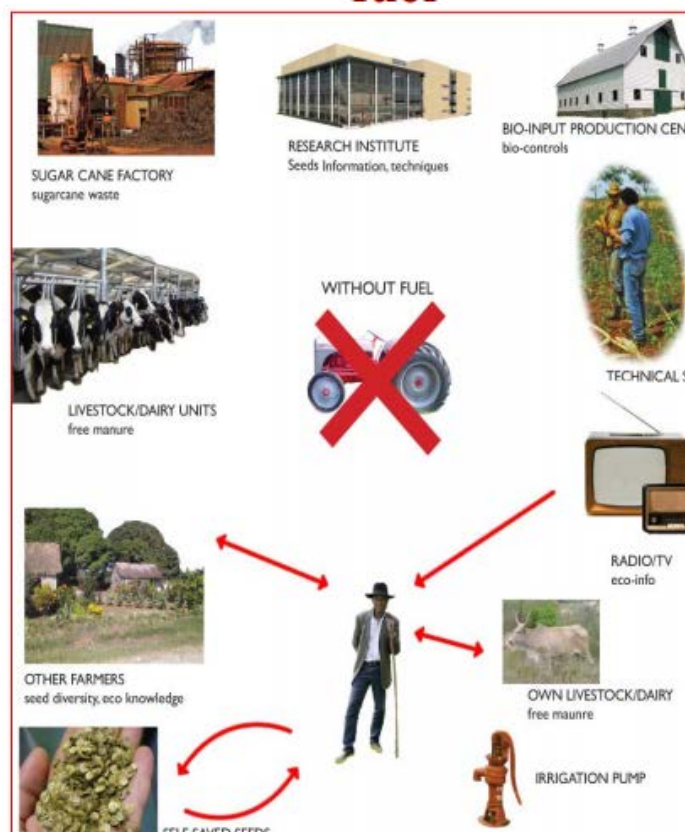


Figure 2: The sudden system change related to the fuel cut in 1989 is presented by Wright, 2014.

pesticides and proceed irrigation. However, farmers without access to fuel will lack mobility, resulting in more isolation and the disability to obtain fertilizers, pesticides and accurate scientific knowledge. Moreover, irrigation based on fueled systems will not work either.

Whether the fertilizers and pesticides the farmers could get with fuel were sustainable or not, farmers had to create a more self-sufficient system. As a consequence, some of the agricultural practices shifted to a more organic form (ibid). It seems that the changing flows in the system (fuel or not, pesticides and fertilizers or not) created self-organization which created much more resilience than previously was the case (Buchmann, 2009; Meadows, 2009). Also, the goals of the government were set differently; from agriculture as main export to being more self-sufficient. Those changes set up a small paradigm shift in the agricultural system as a whole. A full paradigm shift in a system will have the most influence on the behavior of a system, so this explains the rapid and somehow extreme changes (Meadows, 2009).

The process of change

To really understand the causes of the changes in the forms of agriculture, Wright (2014) sketched the following steps have been taking place to shift to the organic agricultural system (note: no trusted scientific research is available to validate those thoughts):

1. Decreasing industrial practices, which include fertilizing and pesticides.
2. Switching to biological inputs.
3. Completely stopping industrial inputs, decreasing the biological controls and increasing natural and local strategies.
4. Developing of and maintaining the balanced systems with continuous learning of small interventions. (Applying inputs on small spots in emergencies.)

When investigating the steps, it can be imagined that the first steps are forced through the block of trading. No (scientific) evidence of lowering inputs resulting in higher yield was available, so the switch was not based at free will at all. Although the yields and health of the soil with low inputs are high, 80% of the sustainable farmers would turn back to conventional farming if possible (Wright, 2014).

Resilience

"Resilience, ..., is the ability of a (social-ecological) system to absorb perturbations and to reorganize itself while system change occurs, or the ability to transform when the system fails." (Dhont, 2010). Within the use of ecosystem services, for example soil fertility, resilience is important. The *ecosystem services*, like a fertile soil, are dependent on individual systems which are related to each other in systems with broader system borders.

In Cuba, the development and health of the people were rather dependent on the import, while exporting large amounts of the national agricultural production. In this time, the soil and the land were not treated right, which caused the system to move further from the (stable) equilibrium and to decrease in resilience. In the time after the Green Revolution, the Cuban agricultural system became more resilient by for example including 'home gardening' to produce food. The small scale food growing is extensively investigated in Buchmann (2009). Buchmann (2009) states that the home gardens are used to grow food for consumption, medicinal or ornamental use. In the research it is concluded that the home gardens play an important role in the resilience and food security of the island. Unfortunately, data of the representation is not available or can be trusted.

The population has found its way to live with the changes and uncertainty and has been continually adapting, which is created by self-organization resulting in smaller farms with partial organic agriculture, social structures and networks of support. Moreover, the increased sharing and distribution of ecological resources as wild plants improved the resilience of food and growing food in the society. Not only the materials are being shared, also knowledge on scientific and traditional base spread fast in the community in times of shortages and market restrictions getting worse (Buchmann, 2009).

However, Febles-González (2011) argues that it is important not to define the use of mechanical agriculture as something bad, and not to promote the idyllic full return to the traditional methods. Both of them should integrate and co-exist, but know-how is needed not to harm the ecosystem-services so that resilience can be kept optimal.

Summarized, the population improved their resilience by creating networks of sharing knowledge, materials, in a self-organisation process. Furthermore, different farming methods have been developed to maintain the resilience in the food system, which will be necessary when the consequences of climate change are being recognized (Wright, 2014).

"...Cuba, whose geo-strategic survival as an anti-US bastion in the Caribbean has relied upon its islandness." (Baldachino, 2007).

Islandness and the broader perspective

The shift to partial organic agriculture has not emerged overnight, but has been thriven by the political and economic isolation. In this final part of the research, the relation with islandness is investigated and the situation will be taken into broader perspective.

Nowadays, the technology has improved in such way, that the oceans surrounding the island are no constrain. It can be assumed that there is no real boundary for the distribution of food anymore. Moreover, oceans are questioned to be a 'highway' or a barrier. However, the United States did isolate Cuba by cutting the trade, and preventing other countries to trade with Cuba. After all, Cuba still has been finding ways to import food and materials, as shown in figure 4 and discussed by Johnson, D.G, (2003). It can be stated that Cuba became partially isolated, and experienced the economic and political powerlessness, resulting in more 'islandness'.

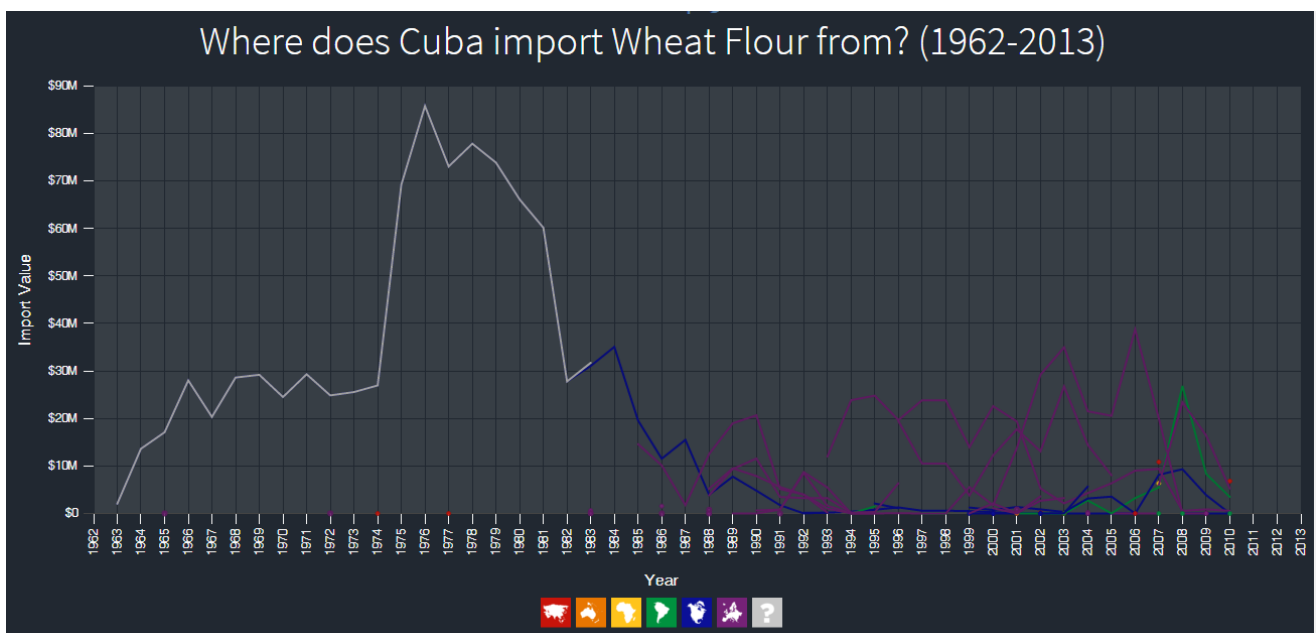


Figure 3: The wheat flour import of Cuba between 1962 and 2013. OEC (2015).

Normally the letting go of input is unimaginable, but because of the islandness farmers were obligated. When visualizing the world, large scale monocultures and overuse of fertilizers are creating the well-known problem of soil degradation (visualized in Figure 4), as has happened in Cuba. Rijdsdijk (2016) states that the soil resources are finite, and therefore important to preserve. Every year, 5-7 Mha is lost by mismanagement of arable land in Cuba (FAO, n.d.). Besides, modern agriculture without dependence on fertilizers and pesticides is impossible to imagine. A collapse in the agro-system, like in Cuba, will hit extremely hard on food security. In this paper, a clear solution for those problems is being given: agro-ecology. More research is needed to determine the findings about efficiency of Funes (2002). Besides, more

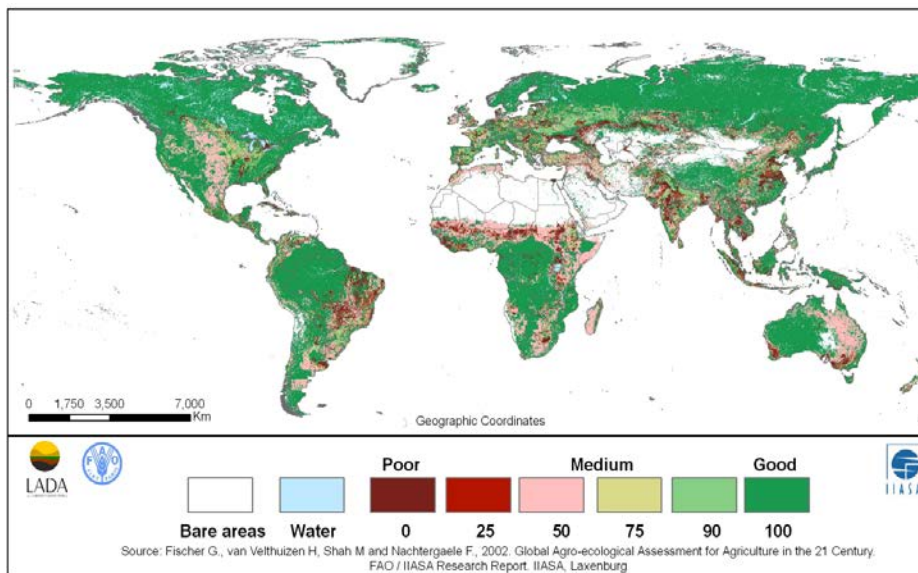


Figure 4: The Relative Health of Soils. The red soils are extremely degraded. Though this amount seems small, soil degradation, related to food security, is a big problem in the world (FAO, n.d.).

research is needed to investigate space efficiency.

If assumed the organic farming is really that efficient, it is reasonable that more countries over the world start exploring the benefits of the organic and (peri)-urban farming. The FAO has been assessing programs in Latin America and the Caribbean to implement urban farming and peri urban farming in the larger cities, to mitigate the food production-related consequences of climate change and natural disasters. The organization uses the Cuban experiences in their method (FAO, 2012).

Generally, the agricultural change of Cuba is raising awareness in the media and organizations FAO. Keeping in mind the steps of Wright (2014), when soil degradation will worsen, the agriculture in the world is not likely to change as in Cuba. It is also possible different –unknown- steps (like the realization when having Cuba as example) will lead to another, more sustainable, form of agriculture, but this should be further investigated.

Conclusion

It can be concluded that agro-ecology in Cuba is very positively sketched by media and tourists, however, only 30% of the agriculture nowadays is happening sustainable. Nonetheless, the islands still has a leading position in the use of and transition to agro-ecology. The vulnerability of food production based on external inputs has been represented clearly in the past of the island, and has been majorly reduced. The “Green Revolution”, or industrial agriculture, put intense pressure on ecosystems and resulted in extreme negative effects, like erosion, loss of quality and quantity of ecosystem services. The vulnerability has to be reduced and soil ecosystem services have to be preserved globally. Although it seems difficult to execute this on a

larger scale than Cuba, a change in the right direction in agriculture would be a shift from a high-level input system to a low-level input system, as this will create agro-ecological farming , which will be guaranteed to preserve the soil ecosystem services, reduce vulnerability and expand resilience. This is not likely to happen in other countries in the near future taking into account Wright's (2014) research, but further research is necessary to confirm this.

Cuba: Revolution on an Island

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Introduction

This essay examines Cuban history and politics in ‘island studies’ perspective. Many scholars have examined the idea of Cuban ‘exceptionalism’, trying to explain the success of a communist revolution in a wealthy part of Latin America, in close proximity to the USA. Cuba’s relevance as a subject of study therefore speaks for itself. However, it is apparent that few if any have taken an overtly *nissological* perspective, that is, one which is concerned with Cuba being an *island*. This essay attempts to rectify that, by examining Cuba’s historical and political trajectory with reference to aspects of the theoretical literature regarding islands. The essay’s central research question is therefore: *how has Cuba’s ‘islandness’ shaped its recent political history?* It finds that Cuba scholars may certainly benefit from the theories and studies emerging from island scholarship, while nissologists may in turn benefit from examining Cuba from their perspective. I begin by looking Cuban decolonisation and its experience with American neocolonialism – with reference to McCall’s (1996) ideas about the continental desire to control islands. From this follows an examination of the Cuban revolution in light of the idea of ‘nissology’, “the study of islands on their own terms” (McCall 1996, 76), positing a conception of the Revolution as a ‘nissological’ one. There follows two sections: the first looks at Cuba’s internationalist foreign policy as a kind of “island survival strategy”; the second looks briefly at migration, a central preoccupation of islands everywhere (Royle 2014), and its impact on Cuban history. The sum of these sections leads to the conclusion that Cuban *islandness* may help to explain, at least in part, Cuba’s apparent ‘exceptionalism’

Coveting Cuba: failed decolonisation

Islanders everywhere, from Ireland to the Falklands, will be familiar with the tendency of continental states to claim unwelcome ownership over them (McCall 1996, 82). Cuba arguably *epitomises* this phenomenon. Under Spanish control long after continental Latin America achieved independence (Whitehead 2007, 2), Cuba subsequently became America’s “obsessive compulsive disorder” (Perez 2014). In the latter years of Spanish colonialism, Washington’s attitude was that “we cannot allow [Cuba] to pass from its present proprietors into other hands” (Perez 2014, 6): Cuba was *intrinsically regarded as someone’s possession*. Cubans were to shift from rule by lofty, imported *peninsulares* (Aguilar 1993, 22), to US effective control; those opposing American annexation, were simply “backwards” (Perez 1999, 159). While reflective of colonialism in general, *islanders* in particular will recognise this attitude: McCall (1996, 76) writes about how islanders have long found themselves portrayed as “troublesome, close-minded, clannish... confounding the schemes concocted by more broad-minded continental dwellers who see the big picture, not the little photograph”. Indeed, Americans thought of themselves as “reluctant imperialists”, forced to intervene in Cuba because the little islanders could not “behave themselves” (Gott 2004, 115f). The physical manifestation of mainland designs on Cuba was the Platt Amendment within the Cuban Republic’s new constitution, handing America the right to intervene to protect “life, liberty, and the pursuit of happiness” (principles taken from the US constitution), and rendering Cuba “a protected Republic” (Aguilar 1993, 39). This was a level of post-colonial foreign control with precedent (Whitehead 2007, 2): a post-colonial experience sharpened by islandness?

Just as some ‘Sub-National Island Jurisdictions’ (Baldacchino 2015) welcome semi-dependency on a mainland power, a “Plattist mentality” (Aguilar 1993, 43), supportive of America’s protectorate, existed within parts of the Cuban bourgeoisie. But others were increasingly discontented by the neocolonial reality. To comprehend how a revolution could succeed in a relatively wealthy part of Latin America, we ought to consider the specificities and extremities resulting from these island-mainland tensions. The liberal principles imported from the mainland seemed to simply translate into a permissiveness towards US capitalists buying up land and assets from bankrupted Cubans (Perez 1999, 106ff). *Of course* capitalists from the enormous US mainland would outcompete capitalists from an offshore island, so this imported continental logic

was structurally unfair to islanders. In the run up to the Revolution, Cuba “reached the limits” of what continental capitalism could provide for a Caribbean island (Perez 1999, 493). Compounding this, Cuba was experiencing a steady growth of imported vice: the island became a hub for American businessmen who saw Cuba as little more than a “storehouse” for their tropical fantasies (Perez 1999, 187ff). Prostitution and gambling, for US tourists, shaped Cuba into the “Las Vegas of the Caribbean” (Eckstein 2003, 17). And it was US support for the dictatorship of General Batista (following a 1952 coup), a prototypical US-backed “gangster state” (Centeno 2004, 409), which really exposed the US mainland’s true contempt for the Cuban islanders’ aspirations (Perez 1999, 449). As islanders do, many Cubans had travelled to the mainland, and returned with new expectations and aspirations; meanwhile, Cuba was subjected to these extreme forms of entitlement and contempt – as an island confronted by a powerful mainland often would: a dialectic developed between the expectations and the reality of American neocolonialism, generating a most indignant ideology of self-determination (Perez 1999, 469-477). The Cuban Revolution, then, was a culmination of this.



Figure 1: An American cartoon from 1914 asserts the positive role played by US intervention “on behalf of these oppressed people”. Cuba has shifted from a figure bent double by the “Spanish yoke”, into an up-standing figure, carrying a sack of “prosperity” and a sign saying “self government”.

(from wikimedia commons)

With the Revolution, continental politicians in Washington were angered by the audacity of the small islanders: the “bearded pipsqueak of the Antilles” was denounced for its lack of “gratitude” towards its US supervisors (Perez 2014, 17). American newspapers’ shifted in their portrayal: “heroic independence fighters” became “a racially heterogeneous bunch of illiterates unfit to govern themselves” (Aguilar 1993, 37). Cuba was a US client-island for the first half of its ‘independent’ existence, and has been under US

sanctions almost ever since it rejected that clientelism (Perez 2014, 1). US politicians have continued to say that Fidel Castro must acknowledge his “wrong choice” and apologise – patronising given the support of the Cuban population for many of the core tenets of Castro’s revolution (Perez 2014, 21). This long history of continental meddling and condescension helped install in Cuba a political culture of “deep-seated resistance to outside interference” (Crahan and Armony 2007, 151). This story of colonialism and decolonisation is undoubtedly *accentuated* by the dynamics of an *island confronting a mainland*. Nissology, “the study of islands on their own terms”, counters the imposition of “continental thinking” (McCall 1996, 76f): the Revolution was essentially a rejection of the logic which placed Cuba as a peripheral subject of American desires. Castro saw the pre-1959, American liberalism-inspired state as a “pseudo-republic” (Hoffmann 2007, 105f). Under his lead, Cuba strived for “the social justice, national independence and economic development that *peripheral capitalism* failed to produce” (Dilla 2007, 89, my italics). The regime constantly

reproduces a dynamic of fiery island *defiance* against the condescension and entitlement of the USA and continental capitalism (Hoffmann 2007, 114f; Hoffmann and Whitehead 2007, 187). Looking at Cuba's historical experiences, it is clearly arguable that much of the narrative – America's obsession with controlling Cuba, and, in turn, Cubans' strong desire to resist that – makes more sense when framed from a nissological perspective. The following section continues in this fashion, applying such framing to the ideology of the Revolution.

The Cuban Revolution – a nissological Revolution?

Islands everywhere have been sites of intense imagination, experimentation, and idealisation (Scarpaci & Portela 2009, 3). Likewise, Cuba has long been subjected to "constructivist", not "realist" thinking (Whitehead 2007, 10f): both the US authorities and the Cuban revolutionaries (and their allies) have seen Cuba as a symbol to be manipulated, rather than an actor to be approached rationally – whether *the* emblem of communist tyranny, to be militantly opposed, or *the* pure revolution besieged by *the* forces of capitalist imperialism. Dualistic imaginings are a facet of island imagology: either a "utopia" of "cultural authenticity" against "decadent mainland cultures", or "a place of corruption and dislocation" and stifling stagnation (Royle and Dodds 2003, 492f; Royle 2014, 118). Isleifsson (2011) teaches us that discourse on Iceland and Greenland were "part of the international power dynamics of the time... a means of justifying which people had control over whom", a phenomenon clearly recreated in the struggle over symbols between the authorities in the US and Cuba.

Islanders elsewhere have used their relative physical isolation as an ideological device – for example, the small body of water separating Britain from continental Europe has long served the ideology of British nationalists rejecting European integration or seeking closer transatlantic relations (Royle and Dodds 2003, 490; Ash 2001, 5f). Between the time of independence and the Revolution of 1959, Cuba was involved in an "archipelagic exchange" with the USA (Perez 1999). Yet even before Cuba had achieved independence from Spain, there were those, like Cuban Revolutionary Party member Benjamin Guerra, who felt that Cuba was a US "satellite... but, she will revolve and have an orbit of her own. She will not lose her identity" (1897) (Perez 1999, 162). Emphasising Cuba's geographical distance allowed *political* distance to seem a legitimate option. But while the Cuban Revolution was an expression of the will to resist continental domination, it is also a project in island idealism, as Castro adopted a "mythical island geography", depicting a gloriously resilient "island of communism" within a "sea of capitalism" (Scarpaci & Portela 2009, 3). The Revolution aimed to overturn the colonial heritage, but it was simultaneously a utopian project, to build a society on socialist principles (Eckstein 2003, 4). Thus, whereas previously Cuba was defined by Americans, for whom it "seemed to rise out of the sea like a sumptuous film set" (Fay 2011, 407), the Revolution is a project to define Cuba in terms of the islanders' own defiant imaginings – simultaneously seeking for Cuba to become an *autonomous* island, and an island utopia.

Cuba underwent a distinctly *patriotic* socialist revolution (Gott 2004, 148f). This might be better understood through the prism of "cultural island phenomena" – whereby, as with biological diffusionism, continental cultural phenomena dispersed to islands take on peculiar *island* forms (Eriksen 1993, 139f). Just as islands are often places "of local pride, community durability" (Royle and Dodds 2003, 488ff), local patriotism shaped the brand of socialism that developed in Cuba. And Cuban political culture has shifted in ways which relate to the variety of potential political uses of 'islandness'. As Fay (2011, 414) puts it, Cuba has undergone "ontological oscillations between archipelago and isolated island". Fay (2011), follows Cuba's shifts between being an imagined *vanguard* at the tip of a revolutionary archipelago, open to revolutionaries from all around the world, into an isolated island, focused on *insularity* against ideological deviations. A history of Cuban Revolutionary politics such as Eckstein's (2003) shows us that Cuba has long shifted between political cultures where necessity – for example, between being part of the Soviet archipelago (for support), or being an island distinct from the Soviet bloc (for autonomy). The regime's constructivists have at times courted US hostility to enhance Cuba's isolation, because it is an important source of political legitimacy for the Revolution (Whitehead 2007, 10f). Both distinct conceptions of Cuba – as the floating van-

guard of international revolution, and as an isolated island sheltered from the winds of continental capitalism – nonetheless build on Cuba’s *islandness*. The following will examine the more practical linkage between the Revolution and Cuban islandness, where this section focuses on imagined linkage..



Figure 3. Celebrating island resilience by commemorating Cuba’s successful resistance to the CIA-sponsored Bay of Pigs invasion. It reads “First defeat of Yankee imperialism in Latin America” (Photo by Frans Persoon; Flickr creative commons).

Revolution: the ultimate island survival strategy?

Upon the Revolution, in typical mainland fashion, Washington

regarded Cubans as “children incapable of understanding their best interests” (Perez 1999, 490) and, like a parent dragging their errant adolescent back home, the continental empire developed a policy to drag Cuba back into its hegemonic fold. The physical and geopolitical massiveness of the USA gave Cuba relative ‘small island’ status, which mitigated its separatism. “Frustrated” decolonisation is a common feature of small islands – where colonies need a new “international protector and benefactor” for their survival, and therefore must again submit to a mainland power (Royle 2010, 204). Soviet support became a simple necessity for Cuba (Dominguez 1993, 102). As Gott (2004, 197) puts it, “now it was the turn of the Russian Empire to assume the historic role of Cuba’s defender”. Castro proclaimed the “socialist character” of the Revolution and praised Khrushchev’s Soviet Union, correctly perceiving an imminent US intervention; the infamous (and embarrassingly disastrous) Bay of Pigs invasion took place soon after (Gott 2004, 192f).

But Castro simultaneously pursued a policy of internationalism which was *not* something Moscow intended: where Cuba promoted guerrilla revolution under Che Guevara's slogan of "one, two, many Vietnams", Soviet leaders were preaching "peaceful coexistence" (Gott 2004, 197ff; Eckstein 2003, 181ff). Thus, rather than simply becoming a "Soviet pawn", Castro endeavoured to, relatively autonomously, shift Cuba from an "essentially peripheral Caribbean island into a player on the world stage", a "leader of the Third World" (Gott 2004, 148). Castro's desire to "export revolution" (Eckstein 2003, 39) can partly be imagined to be a by-product of all the aforementioned 'island idealism'. During the Cuban Missile Crisis, he was apparently willing to compromise Cuban safety for the sake of strengthening "the socialist camp" (Gott 2004, 200) – a willingness to play the part of 'David' against 'Goliath'. Eventually, the part played by Cuban troops in Angola's independence struggle, helping to fatally weaken apartheid South Africa, became a victory for 'Cuba' as an ideal (Gott 2004, 254). Che Guevara himself certainly saw Cuba as a "vanguard" (Dominguez 1993, 107). Perhaps the reason little Cuba had higher aspirations for world revolution than the enormous USSR was



Figure 2. A poster celebrating the relationship between Fidel Castro's Cuba, and Nikita Khrushchev's USSR.

(image from Wikimedia Commons)

related to the way the experience of being a resilient island had captured the imagination.

Yet the realignment can also be understood through a "realist" – self-interested – lens. Islands everywhere have overcome potential weaknesses through "creative" political economy (Baldacchino 2006, 855). Cuban internationalism can be interpreted as a strategy for obtaining resources and ensuring survival (Dominguez 1993, 139). It was theorised that Revolutions elsewhere could give Cuba desperately-needed allies in the struggle against American hegemony (Guevara 2001[1963], 138). Cuba also adeptly marketed its very *existence* as an American island resilient to US political hegemony. Hence, the Soviet Union willingly paid above market price for Cuban sugar, in return for this geopolitical 'service' (Dilla 2007, 91), and since the fall of the Soviet bloc socialist Venezuela has stepped in to become the "*nuevos rusos*" (new Russians) (Hoffmann and Whitehead 2007, 193), protecting Cuba from global oil price fluctuations (Morris 2007, 50). In return, Cuba has provided Venezuela with solidarity and support as Latin American states defying the "geographical fatalism" of US hegemony (Gott 2004, 191). By exporting medical staff Cuba has been able to simultaneously promote socialism *and* cash in on "medical internationalism" (Eckstein 2003, 128ff). Exporting military assistance to 'anti-imperialist' forces worldwide was also simultaneously a source of cash *and* a strategy for projecting Cuban power and ideals (Eckstein 2003, 189ff). Moreover, the policy of aligning itself with 'anti-imperialists' outside the Soviet bloc enabled the regime to convincingly shift from Marxism-Leninism to "revolutionary nationalism" around 1992; an ideology based around resistance to "Yankee imperialism" rather than Soviet socialism, to help the Revolution endure beyond the collapse of the USSR (Rojas 2007, 169f).

A small island thus became an “unlikely ‘superpower’” (Dominguez 1993, 147). Revolution, realignment, and internationalism represented the ultimate island survival strategy. Scarpaci and Portela (2009, 3) suggest that small islands’ malleability might offer a reason why Cuba outlived the Soviet Union. Cuba’s global alliances enhanced this “malleability”. Royle (2015) points out that islands often either undertake a risky “specialisation”, or economic “generalisation”: at first glance Cuba appears to have shifted from a failed sugar specialisation towards attempts to attract income in any possible way, but it is also arguable that the island continues to specialise – in ‘Revolution’. The Revolution enabled a planned economy: and *planning* has been a vital tenet of adaptive island economic strategies elsewhere (Royle 2012, 256f). In Cuba, this has created arguably one of the most efficient supply chains in the world (Peterson 2016). The socialist state’s investments in human development have allowed a traditional sugar plantation island to become an exporter of biotechnology (Morris 2007, 51). And a “tourism revolution” steadily occurs, with the enduring Revolution one of the island’s primary attractions (Jayawardena 2003). This amounts to another manifestation of the creative and adaptive political economy displayed by small islands everywhere, and it all filters back to the Revolution as the core of Cuba’s “drive to survive” in the face of US reaction (Peterson 2016). The next section, finally, will look at the role of migration in shaping Cuban history and politics – something else familiar to islanders everywhere.

Migration and the Cuban Revolution

Second to tourism, remittances formed “a backbone of economic recovery” after Soviet sugar subsidies disappeared (Hoffmann 2007, 112). Cuba has an “immense diaspora” (Gott 2004, 214). The (first generation) exiles in Miami, depicting Cuba as a “prison island” (Gott 2004, 213), have built a “political machine” which has consistently pushed the US government into militant opposition to normalisation of relations (Portes 2007). Cuban emigrants have therefore had a profound impact on island politics. But this centrality of the migrant community is not in itself exceptional: emigration is a key feature of island life around the world (McCall 1996, 82), and it often has profound political effects (Royle 2015). Just as many mainlanders idealise island life, islanders romanticise metropolitan society (Eriksen 1993, 142) and, indeed, Cuban dreamers emigrating to the USA was a perennial feature of island life long before the Revolution (Perez 1999). Many post-revolution emigrants (from the later waves) were fond of the social achievements of the Revolution, and so reflect that traditional islander desire for continental opportunities more than they reflect hatred of the Revolution itself (Gott 2004, 269).

Migration has contributed to the uniqueness of this ‘Revolution on an island’ in several ways. Firstly, Pre- even in pre-revolutionary Cuba, *destierro* (exile) was a crucial formative experience for opposition politics (Perez 1999, 37), including for Fidel Castro and his comrades. Exile and migration has long shaped political movements – from republicans, to Castro, to the modern Cuban lobby in Miami (Portes 2007). Secondly, by 1966 the regime had “exported the opposition” (Dominguez 1993, 107). By and large, the organised opposition to Castro’s government is now based in Miami, Florida (Portes 2007). This has had a unique, stabilising impact on Cuba (Gott 2004, 212). Moreover, the “legitimacy paradox” (Portes 2007, 125) means that the Castro regime is able to continually derive legitimacy from the ferociousness of the exile opposition in Miami, because to many of those who remain in Cuba, the exile community is “white and affluent”, cozying up to the imperialists in Washington while islanders struggled for the sake of the Revolution (Jayawardena 2003, 56). Thirdly, the Cuban island demonstrated a completely novel form of class war: “the wholesale expulsion of the propertied class”, so that the Cuban bourgeoisie is basically intact, but now external to Cuba (Whitehead 2007, 3; Eckstein 2003, 32). In Havana, the former residences of the white bourgeoisie are inhabited by the families of black workers (Gott 2004, 215). Centeno (2004) points out a potential third feature: the creation of a new inequality in Cuba between those able to receive remittances (and tourist cash), and those unable. But it will not be the first time migration has shaped social tensions in an island society (Royle 2012, 253).

Conclusions

Centeno (2004) contends that Cuba is “returning to Latin America” in a negative sense – transitioning from an island beacon of egalitarianism into just another place experiencing rising inequality and precariousness. Yet, arguably, Cuba has always been affected by global trends but able to deal with them in its own way (a core argument of Eckstein 2003) – and this is true of islands everywhere, for there is no such thing as total isolation (see Eriksen 1993). Gott (2004, 325), for his part, feels that Cuba’s relative insularity, as an island apart, during the collapse of the Soviet Union, will mean that Cuba continues to do things its own way. This would mean the endurance of a trend, the key argument of this essay, a trend whereby Cuban history is marked by its islandness. Hitherto, Cuba scholars have attempted to explain its “exceptionalism”, but have yet to assess it from the view of island scholarship. This essay has argued that Cuban national identity has been shaped by the historical experiences of an island off the coast of a grasping mainland; and that unique policies such as internationalism fit into global trends of islands pursuing creative strategies for survival. Future research, then, would involve wider integration of nissology and island studies with Cuba studies. Perhaps the islandness effect has been exponential – earlier historical experiences which amplified islandness led to further ones, and this could explain Cuba’s differences vis-à-vis islands such as Hispaniola. Regardless, this essay has aimed to at least make a convincing case that such an effect does exist.

Chapter discussion & conclusion

As has been made clear throughout the papers, much of Cuban 'islandness' is politically constructed. The US government has long subjected Cuba to diplomatic and economic isolation, through its embargo. In turn, the Cuban government has taken great lengths to maintain the autonomy of the regime – endeavouring not to tie Cuba too closely to the Soviet Union (from a political standpoint), and enabling a shift towards an ideology more about 'national liberation' than big-C 'Communism' in the long-run (Eckstein 2003). Yet this has begun to change (Gott 2004). Although the Communist Party continues to rule Cuba, it has taken certain steps in recent years to implement aspects of the market economy (Centeno 2004). The internet is, slowly, becoming more widely available (Kahn 2015). Cuba is increasingly becoming a tourist attraction for global travellers, providing a crucial supply of foreign currency, and the historical segregation between nationals and foreigners has been broken down: many Cubans in Havana and other main cities will interact with foreigners on a daily basis (Jayawardena 2003). Moreover, the Obama administration has taken steps towards the normalisation of relations with Cuba (Obama 2015): some aspects of the economic embargo have been lifted, and in 2015 each country exchanged ambassadors for the first time since 1961. The US flag was raised in Havana, and Secretary of State John Kerry was present at the ceremony, giving a speech in which he called for greater democratisation of the island (Associated Press 2015). These developments could culminate in the end of externally-imposed isolation, and leave Cuba more open to globalisation and its potentially homogenising impact.

As was discussed in the first paper, Cuba's culture is made up from transcultural aspects. These aspects came from both the African cultures, brought in through slavery, and the white Cuban cultures. The combination of both these cultures made for the contemporary culture there is today. In the paper also the influence of islandness on transculturalism in Cuba was briefly discussed. Due to the fact that Cuba is an island, and isolated meant that during the colonial times it had a different culture and different opportunities than countries closer to each other in the Caribbean. This resulted in the transcultural features of Cuba to be contained and remain significantly different. However, now in times of globalisation this might change. As the embargo on Cuba will be lifted, Cuba's islandness will be affected, possibly also its culture. As was mentioned above, Cuba's culture was able to flourish as it did because of the isolation and containment of the transcultural aspects. Without the embargo, and Cuba being open to outside influences, more than now, the containment of their unique culture might be permeated. This may result in the Cuban culture to be affected negatively in that certain transcultural aspects of its culture can be oppressed by more dominant influences and thus lose its uniqueness. On the other hand, the lifting of the embargo might also result in aspects of the Cuban culture, like its music or religion, being spread to other countries and

Concerning Cuba's twentieth century history and imagery, the fact that it is an island has clearly been of enormous influence. From the exotic image formation and idealized paradisiacal worlds of pleasure by American tourists, to projections of the Communist Utopia for the Soviets, the New Left and peoples in anti-colonial and anti-imperialist struggles, by being an island Cuba has functioned as a projection screen, as both van der Vliet and Isleiffsson have argued on this particular function of islands in general. These projections and images consequently led to attempts of effectuating these romanticized worlds and evidently have been quite able to influence political manifestations to a certain extent. However, moving back to January 2016, the normalization of Cuba-US relations is being carried through for about a year now, and as Peter Kornbluh argues, is starting to accelerate. Although some conservatives try to uphold the embargo as is satirically represented in the cartoon of figure, the floodgates of Cuban-US interaction are starting to open. Cuba is an island whom family members, friends, tourists and business men and women, are eager to visit and contribute to or otherwise influence its development. Without the historical events and developments heavily influenced by the 'islandness' of Cuba, these current fundamental societal, political, economic and social changes taking place as we speak, would most likely not have occurred. But, as the different disciplinary perspectives on Cuba that have passed by have diversely argued, the drastic changes

that the descent of globalization upon the Caribbean island could either be of a positive or a negative influence. In the end, it all boils down to perspective, and not one discipline holds the monopoly on the truth.

The Cuban agriculture has also been affected extremely by the US embargo. Due to the lack of import and exchange of goods, Cuba became more isolated: it can be stated that the 'islandness' increased. Shortages of important resources provoked self-organization in the island, and different agricultural methods started to develop. This caused the resilience of the food production system to increase. Furthermore, the organic agriculture is expected to be more efficient compared to conventional agriculture and will not negatively affect the soil health, so the ecosystem services of the soil will be maintained. Keeping in mind the finite soil resources, the degradation of soils in the world, and climate change in relation to food security, a partial switch to organic and (peri-)urban agriculture could be a solution. The FAO already started spreading the urban food growing ideas. More research on space efficiency, and the general efficiency of organic agriculture, has to be done. The organic part of the Cuban agriculture is portrayed by the media as the main method of growing food. In this chapter, it has been made evident that this is not the case. In fact, again, an utopian island vision of Cuba is dominating. However, the communist island state is likely to become less isolated during the coming years, because the US are seeing a lot of potential development investments (e.g. Economist 2015). If the embargo were to be diminished, Cuba would become less and less isolated. Taking into account the words of Wright, this could cause a lot of organic agriculture to disappear, and return Cuba to conventional agriculture. If this agriculture will be executed the same as in the 'Green Revolution', this would be a missed opportunity for the conservation of the soil health and the development for organic agriculture. When isolation diminishes, the utopian image of Cuba would likely to disappear, as general information will be more available.

One of the primary lessons to be learnt from the final paper's topic, the topic of how island studies can help us better understand history, is one about continental meddling and the desire of islands for self-determination. The impact of greater economies of scale on the continent during the neocolonial era provides a very useful illustration for the differential needs of islands and mainlands. Recent Cuban history may therefore be a crucial allegory for those considering the implications of globalisation in the years ahead. When the embargo ends, Cuban 'islandness', i.e. its isolation, may be decreased, yet as McCall (1996) suggests, islands will continue to be islands even while the homogenising forces of globalisation expand, and are arguably most likely to become sites of resistance to it. In terms of the question of *interdisciplinary* study and its benefits, this paper offered the suggestion that biophysical factors can help to explain the supposedly unexplainable, through its argument that much of Cuban 'exceptionalism' can be explained by its *islandness*. The physical phenomenon of being a relatively small island territory beside a powerful mainland helped to shape the Cuban experience of colonialism and neocolonialism; the vulnerability generated by that status helped to shape the Revolution and what happened during it; the boundedness and insularity helped to shelter Cuba from political crises like the collapse of the Soviet bloc, and shape Cuban political culture – for example, by making it feasible to export the political opposition, and generate a "legitimacy paradox" (Portes 2007, 125).

Overall, then, Cuba provides a very clear model site for the study of the different topics covered in this chapter. And given the high likelihood of major changes which may see Cuban islandness decrease, these topics and their study through the prism of Cuba will continue to be highly pertinent.

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Divided Islands

Same island, different performances

A case study of Cyprus and Hispaniola



FIGURE 1 AND 2: THE DIVISION OF CYPRUS AND HISPANIOLA (GOOGLE IMAGES, 2016)

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Chapter Abstract

This book chapter focusses on the contrasting performances of nation states who share a 'divided island'.

The analysis will focus on the current and future economic status, the differences in welfare and the differences in water management. The two islands that will be analyzed are Cyprus and Hispaniola. What is interesting regarding the divided islands in this book chapter is the fact that countries who share the same island and the related resources can have a completely different development, on economic level as well as with water and sustainability. First, it is interesting to see that North and South Cyprus have completely different economic assets and both cope with dependency. Second, that the Dominican Republic outperformed Haiti, being a leading economy in Latin America in contrast to the economic vulnerable Haiti. Third, that the issue of water, capital for an island, reveals the differences between Haiti and the Dominican and calls a necessary cooperation around water management, to ensure the hydraulic safety of Hispaniola.

After all, divided islands are a helpful model for the analysis of relatively great differences between neighboring actors who share the same area.

Chapter introduction

Besides the common dimensions regarding islands, such as isolation and dependency, some islands have to deal with another major phenomenon, which has an effect on the character of the entire island. Some islands namely contain not just one, but two or even more nation states. These nation states all have their own different nature, ideology and regulations on the one hand, but have to share the same physical location and the available resources on the other. These so-called 'divided islands' therefore are a unique research objects in island studies.

This book chapter contains three different analyses on divided islands, one on Cyprus and two on Hispaniola. Both islands have their own specific characteristics. On the one hand, Cyprus is a relatively developed island in the Mediterranean. The island actually contains just one country, but it is separated into two conflicting nation states, whereby the northern part is not fully recognized. Hispaniola really contains two different countries, Haiti and the Dominican Republic. First, the analysis on Cyprus is about the economic performance of the two counterparts. It is clear that the fact that South Cyprus is part of the European Union on the one hand and that north Cyprus is only recognised by Turkey on the other has a major effect on their economic performance. Thereby, the economic future of the island will be analysed. Reunification as well as continued separation could probably both have its benefits for a stable economic future, regardless of the political obstacles that prevented unification up until now. The dependency of Cyprus as well as the relatively strategic geographical location are the islandness factors, which make Cyprus an interesting research object. Second, the analysis on economic welfare of Hispaniola, that focuses on the factors that caused differences between the two. Despite the fact that both countries share the same island, their comparable GDP has grown apart since the 1960s. The main motivation for this analysis is that the Dominican Republic significantly outperformed Haiti regarding to economic growth. The fact that two basically similar countries who share the same resources have such a different economic performance make Hispaniola an interesting research model. Third, the analysis on water management of Hispaniola. Obviously, clean water is relatively scarce on an island. Hereby, it is interesting how Haiti and the Dominican Republic differ in terms of water management. External factors, like natural events, development and tourism play an important role in this particular issue and can explain the difference between the two nation states.

The current and future economic differences and similarities of North and South Cyprus

Name of Island: Cyprus

Topic: Economy of divided islands

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Amount of words: 3450

Introduction and relevance

When talking about divided islands, the first island that often comes to mind is Cyprus. With a decades-long history of discord, Cyprus is one of the great examples of political and ideological contradictions in our western society. Prior to the current situation of division, Cyprus has a colonial history that is dating all the way back to the predomination of the Roman Empire (Royle, 2015). The last colonial period, when the British were the occupiers of Cyprus, was in fact the origin of the current contradictions in Cyprus. At that time namely, strong Greek Turkish nationalism grew among the Cypriot society (Papadakis et al., 2006).

The contradiction between Greek and Turkish nationalism on Cyprus is going on ever since the independency and the creation of the Republic of Cyprus in 1960, coming to a climax in 1974. The Turkish military intervention that took place that year led to the current geographical division on the island (Papadakis et al, 2006). On the one hand the Turkish Cypriots in North Cyprus, with a population of a little over 300.000 people (TRNC State Planning Organisation, 2013). And on the other hand the Greek Cypriots in Southern-Cyprus, with just under 900.000 residents (CountryEconomy, 2014). Between these two areas there is a buffer zone, also known as the 'green line' (Webster & Timothy, 2006), which is managed by the United Nations. Also there are still two British areas, which remained after the British rule, namely Dhekelia and Akrotiri (Clogg, 2015). The current geographical division of Cyprus is shown in the figure below.



FIGURE 3: MAP OF CYPRUS, WHICH SHOWS THE DIVISION BETWEEN GREEK, TURKISH AND BRITISH DISTRICTS (GOOGLE IMAGES, 2015).

In addition to the current national political situation, the socioeconomic differences between the two counterparts are interesting to discuss. On the one hand, Northern-Cyprus is a self-declared state, recognized only by Turkey. Southern-Cyprus however, has a strong international position, being a member of the European Union since 2004. Thereby, for South-Cyprus trading has become a lot easier and less expensive since the introduction of the Euro-currency in 2008. Northern-Cyprus still holds on to the Turkish lira as their 'national currency' up until today. The fact that Cyprus is an island makes these two separate economies even more interesting. you would, for instance, expect that a reunification provides severe advantages in economies of scale, because the possibilities of a stable internal and external economy on an island are already relatively limited. Thereby, the strategic geographical location of Cyprus, in the middle of an imaginary "Asia-Europe-Middle Eastern triangle", gives the island a unique competitive advantage. The main goal of this paper is to discuss these differences in socioeconomic performance of north and south Cyprus, considering the future of Cyprus in its entirety. In other words: what is the economic future of north and south Cyprus and what are the political obstacles to reunification? To be able to answer this question, the political differences in Cyprus will be discussed to be able to declare why it became a divided island in the first place. Thereby, the impact of 'dividedness' on the socioeconomic performance of the two counterparts will be explored further on in this paper.

Analysis

Political differences and the emergence of a divided island

To be able to place the current situation in Cyprus in the right context it is important to give an overview of the most important political events on the island since mid-twentieth century. In 1960, the British granted independence to Cyprus. They decided so to avoid additional conflict, but mostly because of heavy pressure from the international community (Webster & Timothy, 2006). As a result of the independence however, Cyprus ended up in a kind of power vacuum. Two waves of nationalism that were present within the Cypriot society, Greek Cypriots and Turkish Cypriots, both had a different vision on the political future of the island (Bahceli, 2000). On the one hand, the Greek Cypriots were striving for a union with Greece. This is also known as Enosis, which is the word for union in Greek. This strive was reflected by the form of an armed rebellion group, which was led by the Ethniki Organosis Kyprion Agoniston (EOKA), which means National Organisation of Cypriot Fighters (Papadakis et al., 2006). On the other hand, the Turkish nationalists were against this unification with Greece, because they did not want to lose their Turkish identity (Bahceli, 2000). Therefore, the Turkish Cypriots had their own insurrection, the Türk Mukavemet Teşkilatı (TMT), which means Turkish Resistance Organisation (Papadakis et al., 2006). An unavoidable wave of interethnic violence broke out only three years after the independence. In an attempt to maintain the peace, the United Nations came to Cyprus in 1964. They separated the Greek and Turkish groups by a so-called "Green Line", an area that divided the island into two separate sectors (Papadakis et al., 2006).

Despite the interference of the UN, the following years were far from peaceful. The ongoing strive for enosis by the Greek Cypriots, lead to a coup against the leader of Cyprus, Makarios, on July 15, 1974. This coupe was conducted by followers of the Greek right-wing junta and stimulated by the Greek junta leader Dimitrios Ioannidis (Bahceli, 2000). As a result of this coup, a puppet government was formed, which goal was to implement the enosis (Webster & Timothy, 2006). Already after five days, Turkey intervened military to protect the position of the Turkish nationalists on Cyprus. This Turkish offence divided the island for good, as Greek Cypriots fled en masse to the south, hit hard by the Turkish intervention (Papadakis et al., 2006). This resulted in two ethnically homogeneous parts of the island, Greek-Cyprus in the south and

Turkish-Cyprus in the north (Bahceli, 2000). In the following one and a half year, 185.000 Greek Cypriots were relocated to the south of the island, while at the same time 45.000 Turkish Cypriots moved to the north side. Thereby, a more or less random buffer zone was implemented between the two sides, splitting not only the two ideologies, but also important infrastructure and even some villages right on the border (Webster & Timothy, 2006).

After 1974, the Greek Cypriots were still the superior of the two in public relations point of view, considering that their government 'the Republic of Cyprus' was internationally recognized as the legitimate government on the island. The Turkish Cypriots, who strived for a bi-zonal federation, meanwhile declared the Turkish Federated State of Cyprus in 1975. While the two zones continued to fail negotiations on unity, the Turkish Cypriots declared the Turkish Republic of Northern Cyprus in 1983 (Bahceli, 2000). In the years that followed, multiple attempts have been made to reunite the two sides, however without success. The most important one, the "Annan plan" of the UN from 2004, failed because this plan was rejected in a referendum by almost 76% of the Greek Cypriots, even though it was adopted by 65% of the Turkish Cypriots (Lachler & Kaymak, 2005). The Greek-Cypriots did not want to have Turkish Cypriots as their equal partners. In fact, their strategy was to continue the Republic of Cyprus and to become a member of the European Union, so they would have a stronger position against Turkey. They succeeded in this strategy because only a few weeks after the referendum, The Republic of Cyprus became a member of the European Union (Lachler & Kaymak 2005).

From then on, the Republic of Cyprus have a much stronger position against Turkey then they would have in the Annan plan, because as a member of the EU council, The Republic of Cyprus is able to use its influence on Turkey during the accession negotiations, because Turkey is one of the candidate members for the European Union. Thereby, the Republic of Cyprus convinced the other members of the EU to demand acknowledgement from Turkey, doing so by extending their customs union to the ten new European Union member states (Sözen & Özersay, 2007). In contrast, on the other hand Turkish-Cyprus is until today only officially recognised by Turkey, which makes it almost fully dependable on the Turkish economy. Especially for an island that is highly import depended, this political situation makes that Northern and Southern Cyprus were starting to differ from each other even more, on political as well as on economical level.

Current economic differences and the downside of dependency

The above-mentioned European membership of the Republic of Cyprus has contributed to the economic inequalities between northern and southern Cyprus. Not only because Greek-Cyprus has more access to the world economy than Northern-Cyprus, but also because of their political influences. In fact, the Republic of Cyprus has even managed to block European trading regulations and financial assistance to Turkish Cypriots (Sözen & Özersay, 2007).

Turan Katricioglu (2006) states that the fact that Turkish-Cyprus is a both politically and geographically isolated state has contributed to the inability to develop a sufficient economic structure. Therefore, the agricultural sector is still the backbone of the economy of North-Cyprus. It provides a significant part of the republics employment and export. In addition to the agricultural sector, industry and tourism are the two other main sectors in the economy of North-Cyprus. According to Turan Karticioglu (2006), the political as well as the geographical isolation (island neighbour south-Cyprus is the only physical connection) cause the lack of innovation and improvement of production in both the agricultural and industrial sector. Therefore, the import rate is continuously growing. In 2014, there was a foreign trade balance of -1.650 million dollars (TRNC State Planning Organisation, 2014). Also in the tourism sector, the dependence of Turkish-Cyprus on the Turkish economy is evident from the figures. For instance, 74.7% of the tourists of North-Cyprus in 2014 were Turkish (TRNC State Planning Organisation (2014). This Turkish

dependency makes this sector highly vulnerable. This vulnerability was reflected in 2001, during the economic crisis in Turkey. At that time the lira lost 70% of its value and the tourism industry of North-Cyprus was severely hit, with a decrease of -52,7% of the earnings coming from tourism compared with the previous year. In general, as a result of the Turkish economic crisis, North-Cyprus had a negative economic growth of -5,4% in 2001 (Okumus et al., 2005). Despite their vulnerable and closed economy, in the past few years the economy of North-Cyprus is rather stable and even growing. For instance, in 2014 the GDP grew with 4,9% and there was “only” an unemployment rate of 8,3% (TRNC State Planning Organisation, 2014).

In contrast to North-Cyprus, South-Cyprus has full access to the European markets and a rather developed internal economy. Figures from Cystat (2014) show that the majority of their trade is done with European countries. In fact, 43,6% of their export and 69,5% of their import is traded with European countries. Not surprisingly, Greece and the United Kingdom are the main outlets, with respectively 38% and 30% of the total export. The main economic sectors of South-Cyprus are in the tertiary sector. Services, including tourism, financial services and real estate represent 80% of the total GDP and 75% of the employment at the southern part of the island (Cyprus Profile, 2015). This is a contrast with Northern-Cyprus, whose main economic activities are in the primary and secondary sector. However, despite their more developed economy there are also some less prosperous figures of South-Cyprus. For instance, there is a rather large shadow economy, as well as in other developing countries that recently joined the EU. In 2013, the size of the shadow economy of the Republic of Cyprus was as large as 25,2% of the official GDP (Schneider, 2013). Furthermore, the unemployment rate of the Republic of Cyprus is actually higher than in North-Cyprus. In 2013, the unemployment rate was 15,9% (Cystat, 2014). Also, the GDP decreased with -4% in 2014 (EY, 2014). These relatively bad figures can be explained by the recent Euro crisis, which severely hit Cyprus as well. In fact, despite the fact that South-Cyprus is not as dependent on a single country, like north-Cyprus is on Turkey, still their strong connection with Greece caused socioeconomic problems during the recent Euro crisis. Not only was the financial sector hit by the Euro crisis in general, for Cyprus the consequences were even more severe as the banks in Cyprus had a large amount of bonds issued by the government of Greece. Therefore, they suffered more than other European members because of the sovereign debt crisis in Greece. In general, the average assets of banks are 3.5 times the GDP in European countries. In Cyprus however, this is almost 7 times the GDP, which made the impact on the national economy even worse (Buzaiianu, 2013).

The economic and political future of Cyprus

In the near future, the relatively strategical position of Cyprus will become one of the main assets for their economic growth and this position probably will accelerate the process of globalisation on the island. Especially for North-Cyprus, the strategical geographic position is reflected when considering the proximity of the Baku-Tiflis-Ceyhan (BTC) pipeline. In fact, this pipeline is seen as the new corridor for oil transportation between the middle east and the western world. Being on a strategic oil route, the chances of fast economic development for North Cyprus are relatively high. Thereby, actors like the US will support North Cyprus to become an independent globalized nation state, ahead of their potential membership of the protectionist European Union (Ghosh & Aker, 2006). South Cyprus thereby will probably continue to rely on its relatively large financial sector, after they recently recovered from the financial crisis. In fact, in April they sold one billion euros in long term bonds, which is a sign for a stable economy that is attractive again to foreign investors. The president of Cyprus, Nicos Anastasiades, even stated that their economy is now immune to the unceasing crisis in Greece (Cyprus Profile, 2015).

In contrast to these different economic opportunities between north and south Cyprus, Watson (2007) describes some economic similarities where a potential unified Cypriot economy could benefit from reunification. First, in the tourism sector there are some strong synergies between north and south Cyprus. The stimulation of tourists visiting South Cyprus to go to the Northern part of the island, and vice versa, could give the tourist market of Cyprus another dimension. Second, higher education is a growth sector for Cyprus. When academic knowledge of the north and the south is combined into a high quality educational product, this could be an interesting option for a new generation of talent from the emerging Middle East and central Asia. Watson (2007) finally states that the manufacturing industry in both counterparts could benefit from each other, although it is not potentially a great contributor to GDP growth. Especially the relatively public oriented and aid dependent industry of north Cyprus could benefit from the liberalized and export oriented equivalent in south Cyprus, because in north Cyprus there is a lot of unexploited manufacturing potential. Regardless of these differences and similarities, it is clear that reunification will be the best decision regarding the economy of Cyprus on the long run. According to Fiona Mullen from the PRIO Cyprus Centre (2014) if Cyprus will reunite, the GDP will rise from 20 billion to just under 45 billion within twenty years from now. Without a solution to the conflict however, the GDP will only rise from 20 to 25 billion. Thereby, the annual average income will be 12 thousand euros higher (at constant prices) and also the annual average growth rate will be 4.5% instead of 1.6% (Mullen, 2014). Nevertheless, Georgiou (2009) criticizes the expected economic impulse that will arise from the reunification of Cyprus. For instance, at first you might expect economies of scale will provide the primary and secondary sector large cost savings on the long run. However, nowadays these sectors are that small that these opportunities will be rather slim. Instead, the service sector is by far the most important sector in Cyprus. Georgiou (2009) states however that for this sector the comparative advantages will not be significant. The most important factors for this sector are the strategic geographical location of Cyprus for the external market, the above mentioned highly educated labour force and its modern communication system. With inclusion of North-Cyprus this will only provide a marginal gain to the productivity in the services sector.

Next to the above mentioned economic factors there are in any case some political issues regarding the reunification of Cyprus. For instance, one of the main reasons why the current conflict is not yet resolved is that there is too much of fear and a lack of confidence between the two Cyprian counterparts to create a harmonic common state. Yangou (2014) states that a solution to this lack of confidence could be a conference with the participation of all the political stakeholders, which should aim to create a provisional agreement for the reunification on Cyprus. This provisional agreement should be operative for 5 or 10 years, wherefore both North- and South-Cyprus can work on some Confidence Building Measures. For instance, the trade-off between the return of occupied Greek-Cypriot parts of important cities on the one hand and the recognition of Turkish-Cypriot ports and airports on the other. Thereby, the withdrawal of military groups and the continuation of intensifying cultural and educational exchanges could be two measures that will have a positive effect on the decline of the lack of confidence. Another possible accelerant for the solution of the north-south conflict of Cyprus could be the accession of Turkey to the European Union on short notice. After all, when Turkey becomes a member of the European Union. Indirectly, North-Cyprus will benefit from it. Thereby, the Republic of Cyprus will no longer be able to use its position in the European Union to block European trading regulations and financial assistance to Turkish-Cypriots, as Sözen & Özersay (2007) stated. However, this would not solve the separation of the island.

Conclusion

The breakdown of Cyprus in 1974 into Turkish North-Cyprus and Greek South-Cyprus has caused the emergence of two separate republics within one island. Besides their different visions on the ultimate political form on Cyprus, enosis versus a bi-zonal federation, the fact that Northern-Cyprus is only recognised by Turkey and Southern-Cyprus is a member of the EU causes various differences between the two. On economical level, both have different sectors where their main focus is on. Agricultural and industrial on the one hand for Turkish-Cyprus and the (financial) services sector for Greek-Cyprus on the other. Thereby, both counterparts are in a way highly dependent on external actors: North-Cyprus on Turkey and South-Cyprus on the European Union. As stated earlier in this paper, both have their advantages and their disadvantages. On the one hand, North-Cyprus profits from Turkish tourism, but on the other they were severely hit by the Turkish economic crisis in 2001. The same applies to South-Cyprus.

On the one hand they profit from the EU in general and Greece in particular as their main export market, but on the other they were severely hit by the Euro crisis.

In an economic perspective, reunification as well as a continued separation between north and south Cyprus could have its benefits. On the one hand, there is still enough evidence to suggest that reunification is not necessary. For instance, the above mentioned proximity of the BTC-pipeline, gives the Turkish Republic of North Cyprus an interesting impulse for the development of their own independent economy. Thereby, when we look at the unemployment rate and the GDP-growth figures, North-Cyprus is performing much better than South-Cyprus at the moment. You could even say that nowadays maybe it is better to be dependent on Turkey, which is an emerging economy, than to belong to the EU, which is plagued by crises. Also, South-Cyprus does not necessarily benefit from a reunification as well, because of their own strong financial sector and the fact that economies of scale are not really at issue for their main services sector. Their strategic geographic position and infrastructure are sufficient enough for economic growth in the long run.

On the other hand however, despite current differences in performance of both economies, North and south Cyprus will probably need each other in the future to guarantee a sustainable growth. Especially considering the above mentioned predictions of Mullen (2014) in the PRIO Cyprus Centre report. On political level, there are still a few boundaries to break, but when all actors objectively look at the long term, a reunification will probably be the better option for both counterparts. After all, the geographical strategic location and the limitations of islandness will not change, even if the north-south contradiction will disappear.

Differences in economic welfare between Haiti and the Dominican Republic

Name of Island: Hispaniola

Topic: Differences in economic welfare between Haiti and the Dominican Republic

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Introduction

Hispaniola is a unique island. With housing both Haiti and the Dominican Republic, it is the only island in the world of which two independent countries are fully dependent of. Due to colonial history, Hispaniola is separated in a French and a Spanish part. The western one-third forms Haiti and has a French colonial history, whereas the eastern two-third has been a Spanish colony and is now the Dominican Republic. This historical dividedness creates an interesting case for the study of human action in comparable environments.

The island is rich of natural resources and has a strategical trade position near to the Panama Canal. One would expect both countries on the island to benefit equally from this and have a similar economy and welfare level. The opposite is true. While the Dominican Republic is one of the richest countries of Latin-America, Haiti is one of the poorest (World Bank, 2012). Around the year of 1960, Haiti and the Dominican Republic still had a comparable GDP per capita of just below \$800 (World Bank, 2006). But since then, great differences have appeared. While the GDP per capita of the Dominican Republic has tripled, that of Haiti has halved. This is an enormous difference, especially given the fact that they're both on the same island. This is a striking example of an island being a natural laboratory situation. The external factors influencing both countries have been approximately equal, meaning we can be almost for sure that the big differences in economy are mostly a consequence of political action and economic policies.

The main question to be answered by this paper is: What are the factors that caused the differences in economic welfare between Haiti and the Dominican Republic?

We will start taking note if the geographical and economic conditions were indeed comparable for both countries in 1960. After that we will try to explain the current difference, especially by focusing differences in policies and with keeping in mind the political situation. As a more recent case we will discuss the earthquake of 2010 that happened in Haiti, which also had big impact on the national economy and welfare level. At the end we conclude reflecting on Hispaniola being an island and using it as a case-study for policies in general.

History of Hispaniola

We will start giving a brief history of Hispaniola and its two countries. In 1492, Christopher Columbus was the first European to arrive on Hispaniola. He started a war with the endogenous Taíno population to appropriate the gold and other resources. Just shortly after, almost the complete endogenous Taíno population had died due to the war, foreign diseases and enslaving by the Spanish. This led the Spanish to import slaves from Africa. Around 1668, the French started to colonize the island as well. Because of declining interest in the island, Spain gave away the western one-third of the island at the Treaty of Ryswick in 1697. This French part later became Haiti. After a slave revolt known as the Haitian

Revolution, Haiti became the first independent country led by former slaves in 1804. Shortly after the eastern part gained independence from Spain in 1822, Haiti occupied the whole island until 1844, when the Dominican Republic gained its final independence.

Due to unstable political situation in both countries, the U.S. Government intervened in both countries in 1916, because of its own interests and to restore the order. In 1924 the Americans left the Dominican Republic and the country got a progressive government. However, in 1930 Rafael Leonidas Trujillo seized power and ruled the Dominican Republic with an iron fist until 1947 and indirectly until his death in 1961. During the second half of the twentieth century a few more coups and sham elections took place. Since 1996, the political situation in the Dominican Republic has been stable.

Haiti was left by the Americans in 1934, where-after political instability continued with several military coups. In 1957 Francois Duvalier was elected president in the first universal suffrage elections. In 1964, after a fraudulent re-election, he declared himself president for life and kept his power being a ruthless dictator. After his death in 1971, his son Jean-Claude Duvalier became the new president for life. In 1986 social discontent due to the bad economic situation of Haiti led to public protest and violence and forced Duvalier to flee to France. Shortly after, attempts to start up a new democracy faced new military coups. This ended up in a trade embargo by the U.S. Foreign aid was stopped after international critique on irregularities during new parliamentary elections. Growing dissatisfaction with the government and the economic situations led to armed rebellion. Since then, the United Nations has stationed peacekeepers in Haiti. In 2010 Haiti was struck by a magnitude 7.0-earthquake where 316,000 people died and 1.6 million people became homeless.

Nowadays, big contrasts in welfare exist between the two countries. Haiti is the poorest country on the western hemisphere, whereas the Dominican Republic is a relatively rich country in Latin-America. The difference in GDP per capita only has increased since the last half of the twentieth century. The poverty rates reflect this as well. In 2001, 77 percent of the people in Haiti lived on less than \$2 a day, and 62 percent only had \$1 a day. In the Dominican Republic, these percentages were respectively 11 and 6 percent. The big differences cannot be explained by labor participation rates, since these are comparable for both countries and at some points in time even higher in Haiti (Werner, 2014). This means extreme poverty in Haiti is higher because Haitian workers are being paid much less than Dominicans. This could be declared, and therefore reduced, by economic growth, Werner argues.

'Start conditions' in 1960

Because the islands were already divided at the end of the seventeenth century, one would expect that differences in welfare (also) originate from colonial times. The first thing to note here is that Haiti and the Dominican Republic only have national accounts since 1960. This makes it hard to distinguish at which moment in time the difference between wealth have come to existence. Clear is that in 1960, the two countries had practically the same GDP per capita, namely just below 800 U.S. dollars. In Haiti this had decreased to \$430 in 2005, while in the Dominican Republic it had more than tripled to about \$2500 (Jaramillo and Sancak, 2009). Adjusted for purchasing power parity, by 2014, the GDP per capita in Haiti was \$1800, while in the Dominican Republic it had grown it reached \$14000 (Central Intelligence Agency, 2016).

If these big differences of the last half of the twentieth century really have their origins in a different colonial history, this would mean that they have come to exist due to different designed historical institutions. Acemoglu, Johnson and Robinson (2001) find that high settler mortality rates move Europeans to set up poor institutions. These 'extractive' institutions could persist to the present. The settler mortality rates were however practically equal in the Dominican Republic and Haiti. Comparison of Spanish and

French colonies in growth, corruption and policy volatility did not find significant differences. Other indicators of institutional features are also very similar (Jaramillo & Sancak, 2009; La Porta et al., 1998). In fact, before the 1916 U.S. military occupation, institutions have been poor for both countries. In particular the Dominican Republic had very unstable politics, with a new head of state every 1.2 year contrary to 3.4 year in Haiti. Expanding instabilities led the U.S. to intervene, with own interests as motivation. The interventions were successful: the order was (relatively) restored and the financial matters were balanced again. All in all, it is unlikely that big differences in welfare due to institutions originate from before this intervention.

Haiti has a two times higher population density, e.g. almost the same amount of people living on half of the area. According to Gallup, Sachs and Mellinger (1998) however, this is not necessary a drawback. They argue that countries with a higher population density typically are the richer than others. This can be explained by better infrastructure, demands, linkages and effective market size for technological innovations.

Jaramillo and Sancak (2009) also counter the claim that geographical differences are a major reason why the economy has experienced less growth on the western part of Hispaniola. Geographical conditions do not only influence the productivity of land, but also the quality of natural resources and the possibilities to get integrated with world markets. Beneficial geographical circumstances include temperate regions and coastal regions (Gallup, Sachs and Mellinger, 1998). These conditions are the almost the same for Haiti and the Dominican Republic (Jaramillo and Sancak, 2009). Coastal regions are equally shared and the climate is comparable, especially because it's the same island.

The claim that agriculture was affected by deforestation due to lower rainfall in the Haitian part of Hispaniola, is unfounded. Alpert (1941) found that Haiti and the Dominican Republic had comparable rainfall for a period of 11 years. Data from the World Bank (2012) show that Haiti has just slightly more rainfall than the Dominican Republic, namely 1440 versus 1410 millimeter per year. This is clearly not enough to be a major cause for the existing economic differences. In addition, Jaramillo and Sancak point at the fact that Haiti was one of the richest colonies of the French in the 18th century. This wouldn't have been possible without an enabling Haitian climate, so the big current differences must be explained another way.

In summary, it is not likely that initial conditions differed much far before 1960. The geography is similar for both countries while they're both on Hispaniola and the historical institutions share a comparable colonial history. If there are differences, they are not necessarily to the advantage of the Dominican Republic. Although some social factors indicating a backlog for Haiti already existed in 1960, they were most likely a consequence of policies after the U.S. intervention.

Analysis

Explaining the differences

One thing Jaramillo and Sancak argue to be important, is political stability and stability of institutions. These are connected to the stability of macro-economic conditions. According to the World Bank (2006) the Dominican Republic experienced a more enabling investment climate than Haiti due to both the political situation and en macro-economic conditions being stable. This improved the international trade relationships of the country. Haiti, in contrast, has had a very instable political situation untill the beginning of the twenty-first century. For example, between 1986 and 1990, Haiti had 6 different heads of state. "Political instability affected macroeconomic performance, as fiscal revenues began to weaken while the government pursued heavy outlays on construction works, defense, and loss-making public enterprises.

Extrabudgetary spending continued to expand in the face of civil disturbances, as external concessional assistance declined. The public sector increasingly relied on central bank financing that led to official reserve losses, and external payments arrears emerged, putting rising pressures on the exchange rate and domestic prices.” (Jaramillo and Sancak, 2009 p. 342) The political instability, in particular the coup d’état against Jean Bertrand Aristide, also led to a US trade embargo and a UN oil embargo having a big impact on the national economy. The assembly sector collapsed from an employment of 46,000 to only 5,000 in 1995.

The Dominican Republic has been a more stable country, and also outperformed Haiti in stabilisation policies. These policies are measured by Jaramillo and Sancak by inflation rate (measuring lack of price stability), standard deviation of output gap (cyclical volatility), index of real exchange rate overvaluation (leading to a decrease in purchase power parity) and frequency of years under banking crisis (systemic banking crises).

But the most important factor in explaining the differences in growth rates of Haiti and the Dominican Republic since 1960 are structural governmental policies, Jaramillo and Sancak find. They take in consideration policies on education, financial depth, government burden, trade openness and public infrastructure. With these factors they can at best explain how the GDP rates have come to differ so hugely.

Werner (2014) also makes an attempt to explain what policies could have influenced GDP growth the most in the two countries, and identifies four main factors. The first one is history. Werner argues, just like Jaramillo and Sancak, that historical experiences are not a main factor for explaining the current wealth difference.

As the second element Werner recognizes is education. Secondary education has a significant effect on economic growth (Barro, 2013). The Dominican Republic has relatively high secondary school enrollment compared to Haiti and this number has been growing since at least 1970. For example, primary school completion rate, as an indicator of secondary, is higher in the Dominican Republic. In the 1990s, its rate was 70 percent compared to not even 50 percent in Haiti. Nowadays the primary school rate is above 90 percent in the Dominican Republic (Werner based on World Bank, 2012). Werner also states that the education is also better in the Dominican Republic. This is directly linked to governmental policies. Since at least 1970, the Dominican Republic has structurally invested more in education and its quality. These investments will have had structural contributions to the economic growth.

Werner identifies health as the third important policy factor. Health influences productivity and thereby economic growth. In the Dominican Republic, the governmental health investments have increased in the last 20 years, now nearly doubling the public health expenditure per GDP rate of Haiti. This has not only been visible in public spending, but also in expenditure per capita. The Dominican Republic has a lower adult mortality rate, the life expectancy is about 10 years higher than in Haiti. But both countries rates have decreased due to public spending on health. According to Bloom, Cannin and Sevilla (2004), a one year increase in life expectancy means 4 percent economic growth.

The last factor Werner distinguishes is trade openness. Kraay and Dollar (2004) show that in the 1990s globalizing developing countries grew at 5% versus 1.2% in non-globalising developing countries. They find a strong positive relationship between trade volume and growth rates, stating that this is an accelerator of development. According to Jaramillo and Sancak, this is one of the main reasons for the Dominican Republic's rapid growth in 1990s and Haiti's in the 1970s. It also means that the UN trade embargo for Haiti in the 1990s will have been a main factor in its declining growth rates. On the other hand, the Caribbean Basin Initiative and the approval of the Free Trade Zone Law of 1983, improved the Dominicans Republic's trade openness. In addition, although the tariff rates in Haiti are lower than in the Dominican Republic, in practice it is cheaper to import and export from and to the Dominican Republic. This

is partly caused by superior infrastructure and better shipping connections. This has in turn its on the Dominican Republic's trade position in a globalizing world.

Pozo, Sanchez-Fung and Santos-Paulino (2010) mention a last interesting point, namely the diversification of the economy. This topic has also been discussed in the Islands lecture series by Stephen Royle (2015). One of the challenges islands face is the limitedness of their resources. Two strategies can be carried out; specialization or generalization. Traditionally, most islands have a one-good economy and are specialized in the production of one good (for example tobacco). The risk here is that the demand for that good can suddenly decrease (for example when smoking becomes unpopular). So this kind of economy is very inflexible. Nowadays, many islands diversify their economy and start to produce many different goods. In particular tourism is an upcoming market of which many islands benefit. The Dominican Republic has responded better to this demand than Haiti, Pozo, Sanchez-Fung and Santos-Paulino (2010) conclude. Tourism has become a profitable market in the Dominican Republic.

The earthquake that struck the Haitian part of Hispaniola in 2010 of course had a big impact on the country. More than 300,000 people died and 1,3 million people became homeless. It is known as one of the deadliest natural disasters in human history and probably the most destructive one in the view of Haiti's population size and its economy. The estimations about the economic losses run from 8.1 to 13.9 billion USD, which is more than the nominal GDP of Haiti. It directly meant a negative growth of 8 percent, and according to the Inter-American Development Bank (2010), it may possibly mean 30 percent less growth still in the coming decade. This estimation includes international aid flows.

These aid flows may also have negative effects: "One concern is that large aid inflows may provoke cost increases, real appreciation and Dutch Disease [leading to less foreign investments due to higher exchange rate of the Haitian gourde], increasing aid-dependence and damaging private sector activity not directly related to reconstruction, including the export sector." (Inter-American Development Bank, 2010 p.14) Haiti's export market has growth potential, but if this will be developed relies on the way aid is given.

To conclude, Political instability has been important for Haiti's backlog. But why the Dominican Republic has outperformed Haiti and Latin-America too can be best declared by policies. Important factors influencing economic growth speak in favor of the Dominican Republic, including health, education and trade position and infrastructure. Since the last half of the twentieth century the Dominican Republic has conducted better policies in improving these fields and also diversify its economy. This has had its impact on economic growth. Only on historical grounds no difference can be distinguished.

Conclusion

The fact that Haiti and the Dominican Republic are both on the same island makes it a very special case. Both countries are independent, and thereby fully dependent on the resources Hispaniola has to offer. Both countries share the same place in the Caribbean sea and have no other neighbors. Being on an island creates limitations, in this case meaning that the same limitations must apply for both countries. In literature, no significant environmental differences were found between the two sides of Hispaniola. The circumstances are very comparable, in particular because they are both isolated parts of land without big climatological differences. This, in the view of its political dividedness, makes Hispaniola a very interesting island to study in societal, political and economic view. This comparable environment, combined with the isolatedness of the island, creates a natural laboratory, to compare the consequences of human action and governmental policies.

On historical grounds no significant differences were found too. Although both countries had different occupiers during their colonial history, the stability of their institutions has been similar. At least until the U.S. occupation of the beginning of the twentieth century, no historical institutions will still have big influences on today's economy in both countries. The demographical fact that about as much people live in Haiti as in the Dominican Republic, but on half of the area does not necessarily mean a backlog for Haiti, Gallup, Sachs and Mellinger (1998) argued.

Despite all of these similarities, big differences in wealth and economic growth exist between the Dominican Republic and Haiti. While still having a similar GDP per capita of just below \$800 USD in 1960, for Haiti this had decreased till \$430 in 2005, while in the Dominican Republic it was more than tripled to \$2500. Poverty rates also differ greatly. Whereas in the Dominican Republic about 11% of the people live from less than \$2 a day, in Haiti this no less than 77%. Looking at the poverty line of \$1 a day, 6% of the Dominicans stand opposite to 62% of the Haitians.

Part of these huge differences can be explained by political instability. Both countries have a long history of coups d'état, but in the last decades the Dominican Republic transformed in to a relatively stable young democracy, whereas Haiti continued having a unstable political situation. This has led to trade embargo's in the past and combined with dysfunctional institutions decreased the economic growth of Haiti. The Dominican Republic also outperformed Haiti in stabilisation policies.

But the most important factor according to Jaramillo and Sancak (2009) are structural policies. Next to financial depth, government burden and public infrastructure, three main policy topics accounting for the inequality are distinguished by Werner (2014). These are at first health, being an important factor in productivity of a country. Secondly secondary education, allowing people to find good jobs, and third trade openness. The Dominican Republic has outperformed Haiti in making policies on these three topic. Better trade openness was achieved by inter alia superior infrastructure and higher liner shipping connectivity, making import and export cheaper. Furthermore, the Dominican Republic did well at diversifying its economy, for example by making it ready for tourism.

On top of Haiti's economic malaise, the earthquake of 2010 has had huge impact. Being one of the most destructive natural disasters in human history, the earthquake affected the economic position of the country in a critical way. More than 100% of the GDP in losses were made and the economic growth will probably be determined by the earthquake for years.

All in all is Hispaniola a striking example of an island being an natural laboratory, in its case to better understand the effects of policies on economy. With start conditions being exceptionally similar in 1960, the reasons why the Dominican Republic has outperformed Haiti can be very well distinguished.

The Water Issue in Hispaniola

Name of Island: Hispaniola

Topic: Differences and similarities around the water issue between Haiti and the Dominican Republic

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Amount of words: words

Introduction

Hispaniola, an Island located in the Caribbean, gathers unique characteristics. To give a few numbers, it measures is the tenth most populous island, the 22nd largest island in the world, and the second largest in the Caribbean. But above all, it is home to two sovereign nations, which are Haiti and the Dominican Republic.

But Haiti and Dominican Republic hardly share more than an island. Ever since the war of independence of The Dominican Republic against Haiti, the two countries are opposed, both in term of economy and culture. The Dominican Republic is doing better than its neighbor, and a tense climate reign between the two. While Haiti has not yet recovered from a massive earthquake five years ago, the Dominican Republic is a popular touristic paradise.

However, and as every islands, they share a sens of « islandness ». Islandness is the characteristic that gather all the islands and transcends the particularities of each of them. It derives from the isolation of the lands. It shapes island communities and implies some common issues.

Due to their « islandness », Haiti and The Dominican Republic share a common struggle : the issue of water. Indeed, water is a precious resource for isolated lands. Therefore, the availability and the management of water is a key issue for Hispaniola, as well as any island.

Unfortunately, it appears that despite sufficient quantity of water on the island, the management is not good enough and the pollution of the watercourses as well as the water tables contribute to a poor water quality. As a result, the population of Haiti lacks fresh water. At the same time, in the Dominican Republic, the economic model based on tourism leads to a lot of waste.

It is therefore interesting to study what the current situation is concerning water in both these countries, how they respond to this issue and what future actions it implies.

I will first present the general water situation of Haiti and introduce water supply and sanitation policies in the country, before highlighting the role of NGOs dedicated to water in Haiti, and more precisely the action of the NGO International Action, Bringing clean water to Haiti.

The second part of this chapter deals with the Dominican Republic, its water situation and the impact of its economic model on water.

Finally, we will see that the solution at this problem lays in the cooperation of the two countries. They will have to go hand in hand to ensure the preservation of their water resources, because this resources are actually held in transboundary rivers.

Analysis



HAITI, VIEW OF THE SLUMS, (GOOGLE 2016)

The situation in Haiti today is extremely complex. Besides of all the « traditional » difficulties faced by islands, such as isolation and limited resources, it is also subject to development problems. It is referenced as the 24th poorest nation in the world (IMF, 2014), and one of the issues that can directly be considered as a consequence of this poverty in relation to Haiti's « islandness », is water. This resource is at the same time scarce and often non drinkable. As a result, 45 percent of the population has no access to an improved, safe water source, and only 30 percent has direct access to potable water. Poorer people, 54% of the population who lives with less than 1 US\$ a day, are reliant on water from polluted rivers to supply their households for their daily needs in water.

Lack of water and bad quality water leads to waterborne illnesses and more than a half of the deaths every year are related to diseases such as typhoid, cholera, and chronic diarrhea.

Adding to that, Haiti is also subject to natural disasters, which are hardly overcome by an unstable government. In 2010, a massive earthquake shook Haiti and, among multiple damages, worsened the situation concerning water, especially among the people placed in refugee camps. The already inadequate clean water supply has been devastated.

Haiti is today considered a water-stressed country, and the challenges in the water supply and sanitation are huge. Unfortunately, public services, in the image of the government, are weak and inadequate. The economy is widely dependent on foreign aid, but unstable politics lead to unstable amount of aid. This way, the situation of water supply and sanitation has known ups and downs.

Water supply and sanitation policies

Even if they are not sufficient, water supply and sanitation policies exist. In 2009, a national directorate for water and sanitation has been implemented, in order to strengthen public services and to guide the NGOs. The National Directorate for Water Supply and Sanitation in the Ministry of Public Works is responsible for the implementation of policies, the coordination of donor assistance and the regulation of service providers.

Even though municipalities aim to take responsibility for water supply and sanitation, they still are assisted.

The role of NGOs

NGOs however play a big role in drinking water supply in Haiti. They are located in various localities and focus on different issues related to water. Among them are big international groups, such as Action Contre la Faim, Oxfam, and International Action, but also local organizations, which are the Comité Protos Haïti, and the Association haïtienne pour la maîtrise des eaux et des sols (ASSODLO). They trained qualified workers to execute a wide range of actions. Besides NGOs, the donors are also multiple. The Inter-American Development Bank is the most important, as it is the first donor for this field of action. The World Bank, USAID, and the European Union are also active.

The action of « International action, bringing clean water to Haiti »



IMAGE FROM « INTERNATIONAL ACTION, BRINGING CLEAN WATER TO HAITI » WEBSITE

International Action is one of the numerous NGO's that works in Haiti. It is focused on water crisis. The organization describes its mission as empowering « the people of Haiti by bringing clean water to communities and community organizations in need. » and the « believe that simple, sustainable clean water solutions are key to creating a more educated, healthy, and productive Haiti. » The amount of NGOs working on water issues in Haiti shows the gravity of the issue. The program of International Action can be

found on their website. They mostly work on the availability of clean water by providing chlorinators and water-tanks.

THE DOMINICAN REPUBLIC



The Dominican Republic, in contrary to its neighbor, succeeds to turn its islandness into a strength. The country is today a reference in services, especially in tourism; it is the most visited destination in the Caribbean. With its average temperature of 26°C, its history and culture, the island attracts a lot of tourists.

Concerning its economic development, it has the largest economy in the Caribbean and ninth economy in Latin America. Telecommunication as well as transportation infrastructure are well developed.

As far as we are concerned in this paper, the question of water in the Dominican Republic is much better than in Haiti. Access to water supply and sanitation have increased, and despite the inequalities, 95% of the urban population has access to improved water source and 78% has access to sanitation. Access to water is increased by its derisory price. Indeed, the price per cubic meter of water is derisory in the Dominican Republic, being on average US\$ 0.21.

But at the same time, the quality and continuity of these services is still poor. Government support is still insufficient. Drinking water quality is affected by a lack of good purification systems. According to an analysis (Baum, Rachel et al, 2014), focused on the microbial water quality, « 47% of improved drinking water sources were of high to very-high risk water quality, and therefore unsafe for drinking. »

Public water and sanitation services management

Public services related to water are divided between four offices, each of them having a different function. Setting policies, drinking water quality regulation, residual waste and controls activities, preservation of water, quality norms issues are all devoted separately. But on top of this division, there is no policy nor central entity in charge of water issue. The absence of coordination and national strategy leads to inequalities between rural and urban areas for example, and more broadly, is a drag to the development of the sector.

Concerning the distribution of public water services, they are undertaken by either regional companies, the National Water and Sewerage Authority, and, in rural areas, community-based water boards.

The investments are supported by the central government, who subsidizes regional water companies, as well as international donors, such as USAID, the World Bank, and the Inter-American Development Bank.

But despite the presence of financing, the water sector is hardly improved. Because of good coordination and wise allocation of the funding, millions of US\$ are spent in vain. Water supply benefits generally from

more investments, but without efforts in improved sanitation and wastewater treatment, the results are disappointing.

The impact of tourism on water resources



As said earlier, the Dominican Republic have built much of its economy on tourism. Therefore, water demand is increasing and generates water scarcity and quality issues. The average amount of liters per person and day of water is far more important in the Dominican Republic than in Europe and the United States. According to service providers, in 2004, the hotel industry used 280% more water than (in?) any other Caribbean country.

Because of this overconsumption threatens the water resources. Saltwater intrusion may have reached a vast area of the inland (Werbrouck 2004), and tourist agents, such as hotels, are also a part of the problem as they often waste water.

The need of water management

As we just seen, the tourism-based economy is a threat to water resources. Therefore, the Dominican Republic needs sustainable initiatives to subsist. In order to support the economic activity and the limited amount of freshwater available, an accountable water management is necessary.

The two countries, even though they are opposed in many ways, they are concerned by one essential issue. In my opinion, and according to the following theory, they have much to gain to unify their efforts around the question of water. There even is a urge for the two countries to find more agreements and define a legal frame to the exploitation of the common rivers.

HAITI & THE DOMINICAN REPUBLIC, TOWARD A COOPERATION ?

On the 27th, November 2007, Haiti and the Dominican Republic signed an agreement on the management and protection of the Artibonite river watersheds. This agreement is relevant because the Artibonite river is a transboundary river, and these rivers are the main source of water in the island. The island counts several transboundary rivers which are the Massacre river, the Gens de Nantes river, and the Pedernales river, and they are the most important watercourses.

Both countries largely depend on these rivers, for agriculture, energy, industry, or household use. But the lack of sanitation policies lead to the spoil of these rivers and threatens the hydraulic safety of the island.

The joint statement to this agreement express the will of the two governments to work together, in a sustainable way, on the management of these watersheds, which constitute a source of life for Haiti and the Dominican Republic.

The stake of a cooperation is even more important for Haiti. The transboundary rivers are its main freshwater reserve, and its principal watercourses, used for agriculture, industry, energy production and by households, are born in the Dominican Republic.

According to a study from J.A.Victor, agronomist, irrigation canals allow Haiti to irrigate 40% of its land. In 2000, 30,03% of Haitian energy production came from hydroelectricity.

Unfortunately, the last one makes an abusive use of these rivers, and particularly of the Artibonite river. The Dominican Republic, which is more advanced technically and economically than its neighbor, imposes its will on the rivers. Concretely, it collects the resources upstream, before the border line, without asking or sharing and pollute the water used by the Haitians. There is actually no respect of the basic principles of the international environmental laws. The situation on the borders of the Massacre river illustrates the problem. Dajabon, a dominican town, and the haitian town Ouanaminth are both situated on the borders of the river. Dominican Republic authorities installed several aqueduct and irrigation systems upstream to capture the water, providing freshwater to 90% of Dajabon population. Ouanaminth however, is left with a reduced watercourse and can hardly satisfy its population with only one aqueduct.

Haiti is also responsible of the degradation of water, especially because of a massive deforestation and an anarchic urbanization, which provoques the erosion of the watersheds.

So there is no common management of the common resource, and this situation, besides being bad for the diplomatic relationship of the two countries, is also disastrous for the environment. They both operate and/or pollute recklessly on the rivers.

A legal frame for the management of the transboundary rivers is thus a necessity. This frame would provide with the terms of use of common water, and will base them on a non-injurious use. Every installations, agricultural or industrial on the water borders by one country should be notified to the other, sharing information on the utilization. Moreover, any future project should pass an « ecological test » to ensure its sustainability and avoid pollution. Common projects will be forecasted in order to improve and protect the water borders, such as the containment of the rivers, repair of the watersheds, reforestation. Adding to that, this agreement should provide a diplomatic mechanism in case of conflit.

Conclusion

Watercourses are important for the survival of the actual and next generation of the people in Hispaniola. Therefore, their management should be common and sustainable. It is more than time for the governments to think about a legal and technical frame to ensure the protection of the rivers and the environment. Finding common interests could also be a way to reconcile the two countries.

Despite the economical advancement of the Dominican Republic compared to its neighbor, they both face a major question : the issue of water. They both have responsibility in the bad quality of water supply, in the waste and the pollution of water sources. While water is a urgent question at the moment, the two countries continues to manage, if they do so, their resource separately and without any consideration of environmental principles. As a result, the water is soiled. Paradoxically, there is no cooperation between the two governments concerning this issue, while these resources are in fact shared. Indeed, the main sources of water are transboundary rivers, and their preservation is impossible without a joint work of the two countries.

So, if de facto Haiti and the Dominican Republic are opposed in many points it appears that the survival of the island lays in a cooperation, between water is an extremely important factor for them too, whether it is to provide a descent quality of life to the Haitian population or to sustain the tourism in the Dominican Republic.

Discussion and conclusion

As islands form natural models for understanding our world, divided islands form extra interesting models. They offer us the opportunity to control for many external factors in comparing two countries. By having approximately the same climate, resources and isolation, we can fully focus on the effects different human actions have on several topics. In the papers we discussed how governmental decisions differed on Cyprus and Hispaniola.

The first case study investigated the role of the dividedness of Cyprus on its economies. Here, many differences are seen since North- and South-Cyprus are politically bonded to different parties, respectively to Turkey and the EU. Both countries have developed their economy on different ways, North Cyprus on the one hand relying mostly on the industrial and agricultural sector and South-Cyprus focussing on the service sector. North-Cyprus profits from Turkey by i.a. its tourists, the BTC-pipeline, and the fact that it is an upcoming economy. South-Cyprus in its turn profits from the EU and Greece as being a part of the eurozone. Both countries are also at a risk being dependent, as turned out in the Turkish economic crisis in 2001 and the recent eurocrisis. At this moment, it seems both countries can stay separated from each other and still experience growth, because of their strong partners and because increasing scale is not necessary in expanding the economy. However, on the long run, both countries may need each other to guarantee sustainable growth in the future if they overcome their political differences. The limitations and opportunities of the islandness of Cyprus won't change much after all. The conclusion we can draw on this case is that being dependent or associated with different bigger players in economy has as well advantages as disadvantages when you're limited in your own resources.

Hispaniola, as divided in Haiti and the Dominican Republic, was studied on two different cases.

The first one was an attempt to explain the big existing differences between both countries. Hispaniola here functioned as a striking case in comparing economic and political decisions and policies.

Given the fact that the environmental situation is practically equal on both sides of the island, there can be focused on human factors like governmental policies in explaining the big economic differences that occurred since the 1960s. In literature, a couple of factors were distinguished to have had a major influence on these differences. One of these factors is political instability. In contrary to the currently relatively stable Dominican Republic, Haiti continued its unstable political situation until the beginning of the twenty-first century, with coups even leading to trade embargo's. But the most important factors according to Werner (2014) and Jaramillo and Sancak (2009) form structural governmental policies. The Dominican Republic outperformed Haiti in the fields of trade openness, infrastructure and economic diversification, but also on health care and education quality. Due to the unique opportunity to control for many external factors, these recognised determinants may be a blueprint in explaining and predicting the effect of policies in other developing states in the world.

The second case study on Hispaniola compared the different strategies Haiti and the Dominican Republic deal with water issues on the island. It shows how very divided island may, at some point, have to find some agreements for the survival of their island. The socio-economical aspect of a country can be influenced by many factors, and its evolution in these evolution in this terms can differ a lot from other countries, even if they share the same land. But the fact that two countries share and lay on the same natural resources to develop, will force them to join their action in order to ensure the survival of their land and of their own country.

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Towards sustainable socio-cultural energy development on Madagascar

A case study of Madagascar



Figure 1. Application of the slash and burn deforestation technique for agricultural needs on Madagascar (National Geographic Creative, id 1290854).

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Abstract

This chapter involves two papers addressing the possibilities and difficulties regarding the transition to sustainability of Madagascar. Thereby it addresses two topics, one being its systems of power production, and multiple potential areas of improvement in that field. Secondly, it addresses the present state, history and possible future of its nature conservation projects. This is done with a particular focus on the social and political groups that are, from a local, national and global scale involved in or affected by the construction of its Natural Parks. While the first paper mainly concludes that there is substantial technical feasibility and economic viability for a transition to sustainable energy production, the second paper concludes that there exists a lack of social integration between the different groups involved in the creation of a sustainable ecosystem. This results in friction between the conservation ideas and plans and the conservation project on the ground, complicating Madagascar's path to sustainability. Furthermore, a lack of human development and societal sustainability becomes apparent. Ending this chapter, this discussion will be expanded and analyzed further.

Introduction of the book chapter

There are multiple reasons why studying the island of Madagascar is relevant. The first and foremost of these reasons are the large amounts of endemic plants and vertebrates living on the island. This has been (and still is) what Madagascar is most known for in the rest of the world, both in popular culture and scientific research.

Sustainability plays a central role in this chapter. While this word alone could suggest a wide range of meanings, this chapter focuses mainly on a move to sustainability in Madagascar's energy production and on the sustainability of past, current and future conservation projects with regard to the different social groups that are involved. To be more specific, the first paper sets out to analyze if moving towards sustainable energy production is actually a viable option for Madagascar. In doing so, the paper addresses multiple known approaches of moving towards sustainable energy production for this specific case study, both guided by, and incorporating insights from literature that is relevant to the specific case study.

For both papers, there is a reason to study the topic on Madagascar specifically. The first paper starts out by arguing that implementing sustainable ways of energy production might be beneficial despite the fact that Madagascar is a developing country. Furthermore, the specific island geography presents it with options and challenges for this implementation. Lastly, the aforementioned endemic biodiversity on the island stresses the urgency of moving forward on the issue much more than it would in any other country.

Towards sustainable development on the Malagasy island

Topic: Energy production

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Introduction: The island nation of Madagascar.

Just to the south-east of the African continent, across the Mozambique Channel, the Indian Ocean harbors the fourth largest island on planet earth: Madagascar (figure 1). The country is inhabited by approximately 24 million people, mostly of Malayo-Indonesian heritage. The island is mainly known, and studied, for its biodiversity and high level of species endemism (Goodman & Benstead, 2005). This is not entirely without reason, seeing as approximately 9,704 of the island's 12,000 plant species and 771 of the 987 vertebrates are endemics (Myers et al., 2000). Adding to this, the island has a diverse climate, as it is tropical along the coastline, temperate inland, and arid in the southern regions (CIA, 2015). Although these characteristics give Madagascar a unique position on the world stage of biodiversity and environment, they are also constantly under threat. Human induced damage to the island's ecosystem presents a significant threat to the livelihood of many endemics (Ganzhorn et al., 2001; Dunham et al., 2008). As for the environment, deforestation and overgrazing are causing soil erosion, spilling of sewage and other organic wastes contaminates the surface water, and desertification threatens many of the distinct regions (CIA, 2015).

Although the local challenges described above are important issues that require continuous progress in their resolving, not even an island nation like Madagascar can avoid dealing with equally serious global matters. One of these 'global matters' is climate change, as was emphasized by the recent Paris Framework Convention on Climate Change. The convention yielded a new international agreement with the intention of limiting the impact of climate change (UNFCCC, 2015).

Whereas significant focus has been on the dangers faced by small island developing states (SIDS), for example sea level rise (e.g. Kelman & West, 2009), this does not seem to be a very acute threat to Madagascar. This does not mean, however, that the voiced global commitment to counteract global warming is without complications for Madagascar. For example, among the cornerstones of halting further climate change impact, is the transition to more environmentally responsible ways of energy production. While this may be a far-fetched goal for a developing nation, there is increasing evidence that the expansion of renewable energy in countries like Madagascar can be economically viable (Deichmann et al., 2011).

In order to further explore this statement, a case study of Madagascar will be used to explore the current evidence for a transition in energy production. This is an opportune subject of study, seeing as it allows for an analysis of the problem from a developing nation viewpoint, a deforestation viewpoint, and of course an island viewpoint. The main research question is, then, whether the transition to renewable energy is a realistic option for an island nation like Madagascar. Attention will be paid to the island position (or 'islandness') of Madagascar, and how the various subjects discussed in the paper apply to this subject of study. Firstly, a brief overview of the current economic and political situation aims to create a framework for the further exploration of the subject. Subsequently, the current status of energy production in the region, the motivations behind moving to renewable sources, and specific application of the matter to the subject of this case study will be discussed.



Figure 1: Madagascar and its position relative to the African continent (Google maps, 2015)

Analysis: from context to potential targets for renewable energy

History and current situation of the island

Any history of the island should first be preceded by its geographical origin. Madagascar was originally part of the supercontinent Gondwana (or Gondwanaland), before this supercontinent started to break up approximately 200 My BP. Since then, the continental fragment, microcontinent or island of Madagascar has remained insular for over 100 million years, giving rise to the aforementioned richness in endemic species. (Fernández-Palacios, 2010).

A second interesting topic regarding the history of Madagascar, is its original settlement. By logical deduction, Madagascar was the ideal candidate for human colonization, since it is a very sizable island and it is relatively close to a continental landmass.

Furthermore, the people most likely to be the initial colonists were the nearby peoples of continental Africa. This does not differ all that much from the accepted theories describing animal and plant species dispersal (Menken, 2015). In many ways however, reality turned out to follow a different path (Keegan & Diamond, 1987).

This different path is highlighted by a few anomalies. Keegan and Diamond describe the fact that Madagascar was settled approximately 1500 years later than Samoa, and that most evidence points to Indonesians being the island's first settlers. The reasons for this way of events can be found in geological explanations like island stepping stones, or in the differences in technological capabilities of various settlers (Keegan & Diamond, 1987). Although further discussion of this matter is beyond the scope of this paper, knowledge of the human history on Madagascar does add to the urgency of preserving this island for future generations.

More recent information is needed however, if one is to understand the current political and economic situation on Madagascar. The more recent history started when Madagascar once again became an independent country in 1960, after being a French colony since 1896. The first years of this independence were largely dominated by strong political and economic ties to the former colonial ruler. Especially for the large population of rural people, the transition of power following independence did not have a large impact. In the years following, Madagascar gradually shifted to becoming more of a socialist state, though heavily plagued by corruption (Cole, 1998). In 2001, the country experienced a phase of turmoil as two candidates declared themselves president. Similar problems also arose more recently, in 2009, as civil unrest caused the military to declare the former mayor of Antananarivo the new president. Following this chain of events, the international community intervened and UN supported presidential elections eventually elected the current president (CIA, 2015).

Lastly, an overview of Madagascar's socio-economic status finalizes the framework in which the island can be studied. The island's economy is comprised mainly of agriculture, among which are forestry and fishing. This sector provides about one fourth of the GDP, and employs about 80 percent of the population (UN-FAO, 2013). Before the political unrest in 2009, the production and export of clothing and other apparel products to the United States was a profitable trade (Brenton & Hoppe, 2006). The undemocratic change of power, however, resulted in Madagascar being excluded from important free trade agreements, causing over 100,000 people to lose their jobs. Foreign investments have not yet returned to pre-2009 levels, as they are halted mainly by widespread corruption and a weak business environment. On the level of the internal economy, the usage of firewood as an important source of fuel, aggravates deforestation and erosion on the island, making a case for progressing to the usage of more renewable energy sources.

The African energy status

In the following paragraphs, the current situation concerning energy production in Madagascar and other African nations will be examined, focusing on which challenges could particularly apply to the island state.

In 2014, the International Energy Association published a report called the 'Africa Energy Outlook', in addition to their usual World Energy Outlook (IEA, 2014). The detailed scope of this report allows for a comparison between Madagascar and other countries in Africa. On the next page, figure 2 gives an overview of the access to electricity for all African nations, in both relative and absolute numbers.

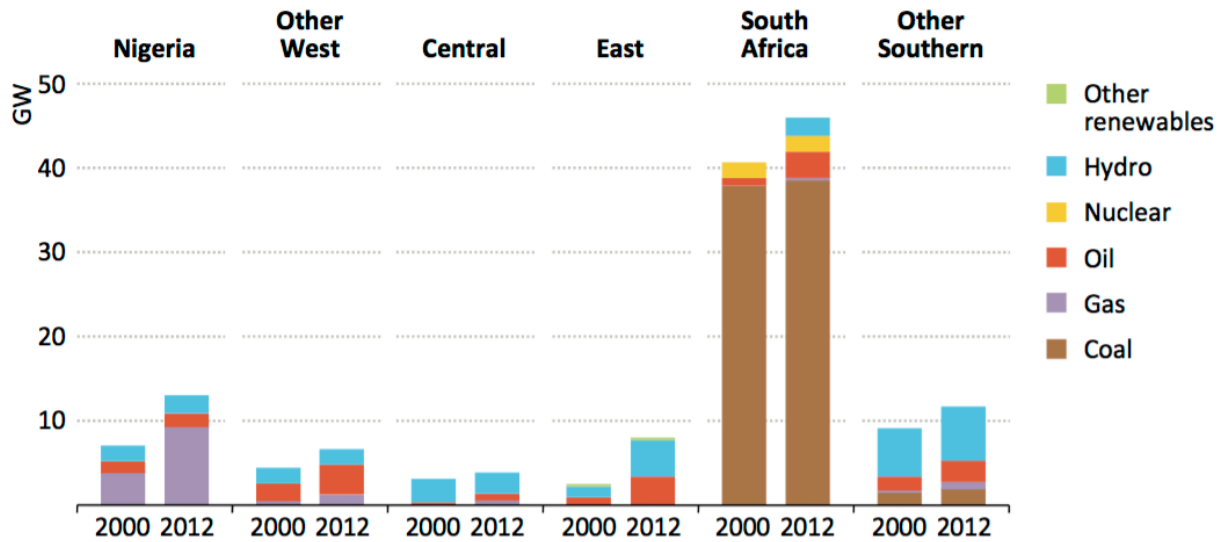


Figure 3: Installed grid-based capacity by type and sub-region (IEA, 2014)

Madagascar itself has an installed generating capacity of 544,200 kW, or 0.54 GW, according to 2012 statistics (CIA, 2015). Of this capacity, 30.1% is produced by hydroelectric plants, and fossil fuels contribute 69.9 percent. Other renewable sources provide only 0.2 percent of the capacity, and nuclear fuels are not used on Madagascar. The relative power capacity generated by hydroelectric- and other renewable energy sources on Madagascar is therefore below the regional average, leaving room for future development.

The fact that Madagascar relies mainly on fossil fuels for its (centralized) power production is somewhat surprising, considering that the island itself is not rich in fossil energy reserves (IEA, 2014). Because of the cost associated with such energy import on islands, the local production of renewable energy appears to be favorable, as is often argued for small island developing states (van Alphen et al., 2006). Although Madagascar cannot exactly be categorized as a small island, in many ways it still is a developing state, which should give them the same urgency for moving towards (renewable) self-sufficient power generation.

The case for renewable energy

In the following sections, a will be made for the implementation of renewable energy on Madagascar. Firstly, two articles discussing the viability of renewable energy for developing countries will be reviewed. Following this, attention will be paid to an interesting case study of wind energy potential on the Canary Islands. Both of these sections also consider the implications of the findings for the situation of Madagascar. The last part of this section will consist of an overview of the not yet mentioned sources of renewable energy, briefly discussing their principles, and how they might function in Madagascar.

Deichmann et al. (2011) focus on the possible implementation of renewable energy in sub-Saharan Africa. Arguing that the lack of access to electricity is among the most important determinants of poverty in the region, they list two reasons why renewable energy could be appealing. The first reason is in the enormous potential renewable energy has in sub-Saharan Africa. For example, Namibia could potentially produce its current energy demand 100-fold when exploiting these sources. Madagascar also has a large potential, with a possible production of 14 times its current demand (Buys et al., 2007).

The described potential consists mainly of biomass, solar power, wind energy and expansion of hydroelectric plants already in place.

The second reason is derived from expected carbon taxation at some point in the (near) future, which would mean a clear economic advantage for developing nations with big surpluses of renewable energy. In the subsequent parts of their paper, the authors investigate the potential roles for central and decentralized energy production. The main outcomes suggest that decentralized power generation will play an important role in rural development, although the costs are relatively high (Deichmann et al., 2011).

For the case study of Madagascar, these findings present some interesting relevance. Recalling that large parts of Madagascar are rural agricultural areas (see 'history and current situation of the island'), and that this sector is a major factor in the country's economy, bringing a reliable supply of electricity to these regions could have profound impact on its GDP (Martínez & Ebenhack, 2008). The availability of electricity has the potential to improve education of children in rural areas, by paving the way for computer availability, giving them better chances in the current information era. Availability of electricity to households might lower domestic demand for energy produced from firewood, potentially slowing down deforestation. At the same time, moving away from using wood as a fuel source for cooking presents less air pollution and significantly reduces health risks (as a side note, the same health risks were faced by Vikings in historical times, when they gathered around fires in poorly ventilated Norse houses! (van der Liet, 2015)). Furthermore, this development is usually indicative of moving up on the Human Development Index (Goldemberg, 2001). However, the technological advancement caused by more steadily available electricity could also enable the agricultural sector to increase the efficiency of its practices, creating a demand for more farmable soil. As outlined in the introduction, the direct consequence is deforestation and soil erosion, which will further threaten the precarious position of endemic species on Madagascar.

The second article exploring the potential implementation of sustainable energy in sub-Saharan Africa is by Dasappa (2011). Dasappa not only underscores the importance of available electricity for development, but he also specifically evaluates the usage of biomass energy as an important source. Following a section warning about the dangers of deforestation on Madagascar, further encouraging the usage of biomass for energy production seems somewhat odd. However, the responsible usage of biomass for energy production does appear to be the most likely real-life solution. Using off-grid generators, as described above, biomass could bring power to electricity deprived rural areas.

Using data from the Food and Agriculture Organization of the United Nations (FAO-UN, cited earlier), Dasappa (2011) proposes the usage of agricultural residues to provide the needed biomass. This solution does not appear to have a negative ecological effect, and the energy potential for Madagascar is fairly large (figure 4).

Country	Cereal production in million tons*	Agricultural residues in million tons	Power potential at 30% availability, MW
Libya	0.213	0.213	8
Madagascar	3.391	3.391	127
Malawi	1.843	1.843	69
Mali	2.845	2.845	107
Malta	0.012	0.012	0
Mauritania	0.125	0.125	5
Morocco	8.604	8.604	323
Mozambique	2.007	2.007	75
Namibia	0.107	0.107	4
Niger	2.672	2.672	100
Nigeria	22.783	22.783	854
Rwanda	0.319	0.319	12
Senegal	1.085	1.085	41
Sierra Leone	0.309	0.309	12
South Africa	12.352	12.352	463
Sudan	3.643	3.643	137
Swaziland	0.071	0.071	3
Tanzania	5.020	5.020	188
Togo	0.787	0.787	30
Tunisia	2.155	2.155	81
Uganda	2.625	2.625	98
Zambia	1.364	1.364	51
Zimbabwe	0.837	0.837	31

*The agricultural residues are estimated at crop to residue ratio.

Figure 4: Agricultural residues and power generation potential in Africa (Dasappa, 2011; originally FAO-UN). In this table, the modest ratio of 1:1 for crops produced to residue left has been chosen, resulting in equal values in the second and third column. The far right column shows the potential amount of power for the case of 30% available residue.

The subsequent part of the article focuses mainly on the technicalities of deriving energy from biomass using various methods. Although interesting, it is outside the scope of this paper. Most important is the large amount of potential energy, and the strong practical applicability for the Madagascar case. Adding value to residue biomass is not unlikely to result in a more conscious practice of agriculture. A major positive effect would be the reduced demand for firewood, with its aforementioned consequences. Furthermore, farmers on Madagascar might need less soil for agriculture, seeing as the added value of crop residue means less crops are needed to generate the same family income. This effect could halt further deforestation, or even encourage planned reforestation, either for energy production or export. Like in the previous section, a negative effect on the Malagasy environment can also be induced. In this case, it may be financial stimuli that lead to exploitation of more land for agriculture. Solutions to these problems may be found in improved governmental functioning and regulation.

In order to explore a specific option of renewable energy for the island of Madagascar, attention will now be paid to a case study of wind energy for the Canary Islands (Bueno & Carta, 2006), in order to see where their conclusions might apply to Madagascar as well. The problem they target in their paper is the applicability of wind energy on islands. While wind energy could help islands meet standards for reduced carbon emissions, the naturally variable power output limits the current application of this source. One of the possible solutions to this problem is using wind powered hydro storage systems (Bueno & Carta, 2006). In this scenario, wind power is used to pump water from a lower to a higher reservoir, whenever the wind turbines are producing energy. The potential energy that is produced and stored this way is subsequently capable of meeting flexible energy needs.

While the authors conclude that this type of system represents an enormous, yet barely exploited potential for the Canary Islands, the same could be argued for Madagascar. Firstly, Madagascar already uses hydroelectric energy to provide around 30 percent of its energy needs. This means that functioning hydroelectric reservoirs and generators must be available. The energy generated by wind turbines could simply be used to increase the output of current power plants, without the need for expanding the electricity infrastructure.

When faced with an increased power output capacity, actions can then be undertaken to expand central power-grid access to rural areas, leading to potentials and risks that have been discussed in earlier sections. On the other hand, the supposedly high initial financial burden for the Malagasy economy makes the introduction of these systems something of a far-fetched goal.

Thus far, biomass, wind energy and the general potential of supplying electricity to rural regions have been discussed. Therefore, concluding this section of the paper, a short overview of the potential energy sources that have not been mentioned yet.

One of these is solar energy. Like other equatorial countries nearby, Madagascar has a relatively high solar energy potential. Additionally, solar power is particularly qualified agent for bringing electricity to rural regions. Relatively high cost per unit of energy output are often mentioned as counterarguments (IEA, 2014).

While not a renewable source of energy, the availability of uranium resources in sub-Saharan Africa also gives potential to nuclear energy. The main argument in favor of its application is the theoretically high energy potential relative to current demand, as well as reducing carbon emissions. However, the lack of technical expertise to maintain nuclear facilities, the absence of a well-developed electricity network, high costs and being unfit as a long term solution all argue against the use of this power source for Madagascar. Lastly, tidal- and wave energy could have potential because of Madagascar's vast coastline, but the cost of application and possible negative effects on the coastal sea floors (Neill et al.,2012) limits the likelihood of it being applied anytime soon.

Conclusion: what have we learned so far?

As posed in the introduction, the central question has been whether renewable energy is an option for countries like Madagascar, and how well it is applicable to Madagascar itself. The urgency for this matter is mainly represented by the large amount of Malagasy that lack reliable access to electricity, as demonstrated by the IEA.

Hence, following several examples, this paper has argued that renewable energy is not just an option for Madagascar, but also a sustainable way of increasing GDP by improving rural access to electricity, thereby potentially ameliorating the efficiency of the island's agricultural practices. Two of the possible energy resources discussed are most likely to provide this renewable energy. The first one is residue biomass, which has the most realistic chance of application on Madagascar. The large agricultural tradition can provide the needed residue biomass, allowing off-grid energy production all over the country. Drawbacks, however, are found in moving from energy potential to actual electricity. The second best option for Madagascar is using wind energy to improve the already substantial yields of hydropower. The fact that important infrastructure already exists favors this approach, but high costs make its application less likely than biomass residue.

While exploring the subject of renewable energy for developing countries, I found that the challenges Madagascar faces on this terrain, are very much like the challenges faced by non-island countries in the same region. There is a take home message to the story though, because on one front, the 'islandness' of Madagascar sets it apart. While multiple countries in the region face habitat loss for its animals, the high number of endemic animals and plants on Madagascar means that current practices could lead to distinctive species being forever lost to the world. If nothing else, this alone should motivate the transition to sustainability.

Friction and exclusion around and about biodiversity conservation projects in Madagascar

Topic: Anthropology in sustainability

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... conservation biology energizes contemporary popular practices of nature appreciation in which learning the names of species creates a vitalizing intimacy with nature [Wilson 1992]. Species orientated nature appreciation – from birdwatching to wildlife television – had a well-established place in late twentieth century metropolitan cultures. Conservation biologists were able to draw on this popularity, and build it, as they showed the importance of conserving the diversity of nature. Working together across lay and technical lines, conservation biologists and environmental activists have made attention to biodiversity – including the practice of species lists – the first requirement of conservation itself. (Tsing 2005: 158)

Global efforts to preserve the world's natural heritage for future generations focuses (through a bilateral and multilateral interplay between donors and recipients of environmental aid) on so called biodiversity hotspots. These hotspots are territories that are rich with natural life and habitats, and that are – as is symptomatic of the history of the international division of labour – generally located in underdeveloped and poorer countries (Miller *et al.* 2013). This means, among other things, that 'on the ground' biodiversity conservation projects most of all affect the lives of those who globally are most disadvantaged (e.g. through the legal reshuffling of landownership as part of national environmental policies). Moreover, new national parks are often constructed in rural areas at the expense of land of small-scale farmers who are, from a point of view of the city and the developed world, living in culturally peripheral spaces and marginalized economies (Keller 2008; Thomas 1992; Raik 2007). In other words: the external costs (or externalities) created by conservation projects (e.g. complicating or discontinuing communal ways of living) are often paid by peoples who occupy the lower social-economic strata within developing nations. These are the people that live their lives in direct interrelation with the nature that is the object of global conservation plans.

The large island developing state of Madagascar is one such biodiversity hotspot considered of great importance to the project of conserving earth's natural heritage. As a consequence of Madagascar being an island almost all beings that live and die upon it are endemic to it (Isambert *et al.* 2011: 1902). As a vast evolutionary niche it carries a unique part of our natural world. This attracts tourists from all over the world, makes it a genetic treasure for bio-prospectors who are developing future pharmaceuticals, and it is why it provides all kinds of ecosystem services that, e.g., allow for climate regulation or the growth of food. Hence, Madagascar is, and its people are, rich in natural capital.

But not all of nature is valuable as something outside ourselves – as an animated collection of objects producing capital. Although it might be practically very useful to put a value on nature, in that it allows for a congruence between economic action and ecological life, it should not be forgotten that humanity; our culture, livelihood and being, is part of nature. That when we speak of losing nature we inevitably speak of losing ourselves too; our habitats, ways of living and ultimately the conditions for (healthy) human life, such as is provided by freshwater resources (Corvalan *et al.* 2005). Likewise – now that the era of the anthropocene is upon us, and the geological forces that act upon the living and the lifeless are becoming increasingly technological – this means that when we act upon (the loss off) nature we act

upon ourselves. Previously perceived boundaries that divided nature and culture are becoming experienced as permeable again, albeit differently than before industrialization (Latour 2014: 5).

But how different really? In his study concerning pre-colonial societies on two oceanic islands, Patrick Kirch (1997) observes that different societal choices in the light of ecological changes resulted in the depletion of natural resources on Mangaia (of the Cook Islands) but in the sustainment of the natural resources on Tikopia (of the Solomon Islands). Kirch suggests that social and geological scale played a decisive role in differentiating the outcomes of the decision processes on the islands. Concluding his paper, he writes:

... intimate scale surely encourages *collective decision making*. "Matou Nga Tikopia" (we, the Tikopia) is a phrase that binds them all as a social unity. Mangaia, while by no means a large island is just big enough that its valleys can each encompass a social world. A mentality of "us" and "them," Keia versus Tamarua and Tamarua versus Ivirua, can develop in even such a mid-sized geographic space. *Perhaps it was an inability to recognize that what happened in the next tribe's valley was also your concern that led Mangaia along its own historical pathway.* (Emphasis added, *ibid.*: 38)

Following Kirch this paper analyses the socio-political process of decision-making (the interplay between the groups that are involved therein) that shapes the conservation project on Madagascar on paper *and* on the ground. As a model for thinking it uses the oceanic islands described by Kirch, thereby viewing the different social scales that are implemented in the socio-natural landscape of Madagascar as analogous to the valleys encompassing the social worlds on Mangaia. Furthermore, one can conceptualize these scales as social islands, being at the same time divided by an ocean of particularities; localized cultural differences (including different life goals) and socio-economic positions, and connected by an ocean of universals; human and non-human existence within ecology, movement and intersections of trajectories, and ultimately the intertwinement of fate.

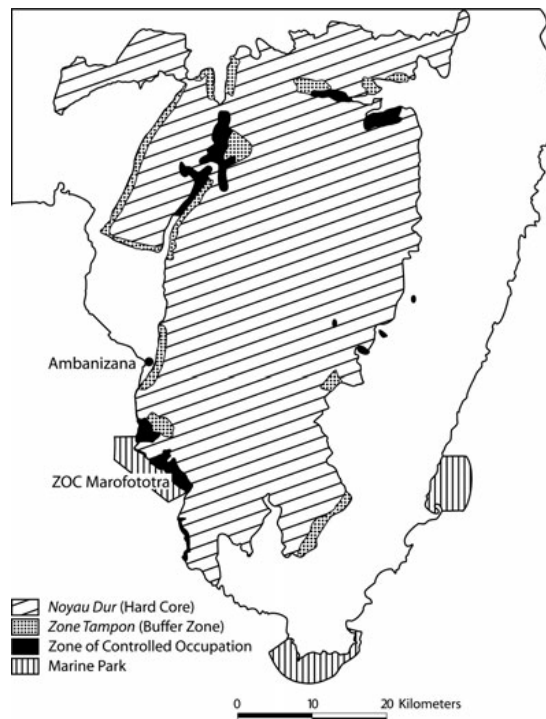
Thus, the questions underpinning this literary study are: What local, national and global histories of thought and action intersect at the present efforts to conserve Madagascar's biodiversity? What can be said about the social cohesion that structures (possibly awkward, unknowing and/or unwanted) collaborations between parties involved in and affected by the creating of Madagascar's National Parks? Overall, where can processes that encourage collective decision-making be identified and where are people being excluded? And finally, is there any room for improvement? In other words: what can be learned from looking at the global connections between the social worlds of the scaled 'valleys' that shape Madagascar's socio-natural landscape?

In the coming sections I will set out to explore the socio-political scales implemented in the natural landscape of Madagascar, beginning at the local level and working my way up via the national to the global. Then in the final section of this paper I will combine the findings of the different scales and discuss the ways in which the practices within particular scales are collaborating across scales. Thereby concluding that, for the sustained future of the conservation of Madagascar's biodiversity, more attention effort needs to be geared towards the inclusion of the local rural population. By enabling them to be included, on their own terms, in the conservation practices of conservation is a means by which the local people can take responsibility for their own lives. Moreover it creates sustainability for the conservation projects and for Madagascar as a whole; its natural and societal scape. My overall goal herein is to contribute to the insights on the state of environmental justice on Madagascar and to the social sustainability of its biodiversity conservation projects.

The Local: The Malagasy ethos of life and the construction of Masoala National Park

In this section I will explore the social world of the Malagasy rural community, as it encounters present day conservation policies of the Malagasy government. But first I will shortly set out a brief historical outline of Madagascar's rural society in relation to its city areas, or maybe I will do this in the next section where I write about the national scale.

The anthropologist Eva Keller (2008) has studied the relationship that horticulturist Malagasy have with the land they live on. Her fieldwork took place in two rural communities on the Masoala peninsula, in the south-east of Madagascar. Her main goal in doing this research was to understand what intention the farmers attribute to the conservation practices that they in recent years have come to know through the establishment, in 1997, of the Masoala National Park and, in 2005, of marine protected area. The forest in this region, which is almost entirely covered by the park, is considered to be a primary forest by conservation biologists. Here you can see a map of the Masoala National Park, the peninsula and the sea surrounding it:



Although she discusses localized culture, a great deal of explicated shows patterns that are recognizable throughout rural Madagascar.

Discussion and Conclusion of the book chapter

The subjects in both papers provide lessons for other settings. The first paper has discussed what the best options are for sustainable energy development on Madagascar, but most of the findings are also applicable to other countries. There is also room for further research, however, because not nearly enough is known about the exact system of reliable electricity distribution in rural areas for the island of Madagascar. This has necessitated the first paper to make some assumptions about the attainability of sustainability goals on Madagascar, that might turn out not to be realistic. Collecting more precise data on these areas would allow for more precisely targeted advice.

Both research questions have been answered in the individual papers. In the first paper, the main answer is that moving towards sustainable energy production is not only an option, but it is also very much economically viable and technologically feasible.

There is an interesting discrepancy between the two papers however, that may have been clearly visible when reading the papers in the order that has been presented in this chapter. The first paper takes the standpoint of finding out more about the technical possibilities and economic potentials under the assumption that moving towards more sustainable ways of energy production could only be good for the island. Following this argumentation, one would expect no objections against swiftly moving forward in the implementation of such plans. The second paper however, presents a much more nuanced view of how different social and political groups interact in moving towards sustainability.

The discussion around this point is summarized best by stating that the theoretical predictions and intentions do not always coincide with the wishes and ways of life of the people that are actually affected by the plans. For the case of Madagascar, the slash and burn techniques applied by the native population seem wasteful and against the principle of sustainability in many ways. It is, however, a major part of the culture of these people, which makes it incredibly complex to find ways to move towards (energy) sustainability in a socio-culturally responsible way.

With these papers, the aimed achievement has been to gather more insight in sustainability movement on the island of Madagascar. Multiple sides of the problem have been analyzed, and the discussion has showed that an interdisciplinary approach (that is mindful of socio-cultural consequences) could be the best way to the actual realization of sustainability goals on Madagascar.

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The cultural waters of the West Frisian Islands

A case study of the West Frisian Islands.

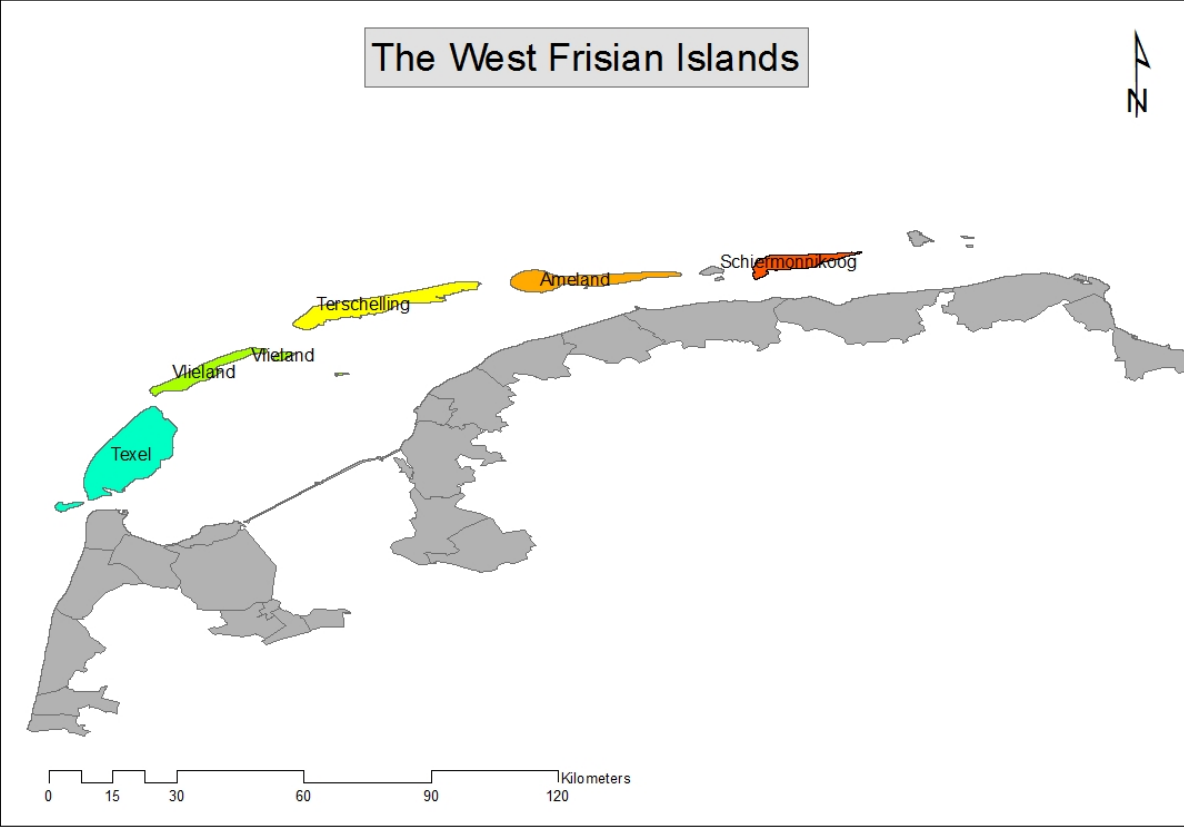


Figure 0. Topographic Map of the West Frisian Islands (ArcMap, 2016).

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Abstract

In this chapter we will visit the West Frisian Islands, also known as the Waddeneilanden in Dutch, and look at two very different topics concerning this island region. One part will look at how West Frisian island traditions are being represented in contemporary island imagery and the other part will examine how sea level rise affects the usage of the surface water available in the West Frisian Islands. The first paper argues that the fact that these traditions are being represented in a very dystopian way means that we still uphold a certain black and white way of representing islands - as either a dystopian hell or an utopian paradise in cinema and literature. The second paper argues how long-term projections on rising sea levels are not incorporated into present policies on groundwater extraction. As uncontrollable effects of climate change result in a diminishment of fresh groundwater volumes on small islands such as the West Frisian Islands, strategies should be implemented to mitigate the consequences.

West Frisian Islands chapter introduction

Off the coast of the Netherlands, Germany and Denmark lies a string of islands that stretches for over 450 kilometers and are named the Frisian Islands. Because of the length of the archipelago the islands are divided into three groups; the Western (Dutch), Eastern (German) and the Northern (Danish) Frisian Islands. The Western Frisian islands consist of five populated islands and are, in order from west to east; Texel, Vlieland, Terschelling, Ameland and Schiermonnikoog. Instead of the Dutch Antilles, which know a radical different climate and cultural conventions, these islands provided an unique opportunity to study islands and island dynamics within the same cultural and climatological borders of the Netherlands.

Both reports found in this chapter limit themselves to the Dutch Western Islands to reduce the scope and to be able to provide a more focused outcome. Another reason is that few scientific papers are written on the Frisian Islands as a whole and thus the larger part of specific information is found in domestic articles. This language barrier limits the information to English and Dutch sources.

This chapter covers two very different topics about the Wadden-islands, ranging from culture to groundwater resources. Henk has researched how rising sea levels have affected the usage of surface water on the West Frisian Islands and Joost will analyse how West Frisian island traditions are being represented in contemporary island imagery by using a case study from contemporary horror cinema, specific the 2015 television movie *Sunny Side Up* (Blok, 2015)

The festivals and traditions celebrated on the Wadden Islands are not only essential to the formation and retainment of their local Wadden islander identity (Ginkel 10), but also plays a crucial role in how the image of the island is formed, how it's being represented and how 'outsiders' view their culture. To study how these festivals are being represented, this paper will analyze mainstream contemporary cinema - through which we can analyse this representation and view of the Wadden islands and their traditions. In particular, it will focus on the tradition of Sunderklaas or Sunneklaas, an annual winter tradition on the Wadden islands, and the ambivalent representation - dystopian hell of utopian paradise - in island imagery.

The study on groundwater resources on the Western Frisian Islands focusses on the effects that a rising sea level has on the islands and on the mainland of the Netherlands. As climatological models predict a rise of sea level the importance of studies on the consequences increases likewise. This study has set its objective on providing more insight on future trends in context of Western European islands.

Islands: The West Frisian Islands

Title: The Horror Mask of the West Frisian Islands: a case study of the representation of West Frisian Island traditions in contemporary mainstream cinema

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In the north of the Netherlands lay five Dutch islands who are a part of an island chain called the Wadden islands. The five islands are, in order from west to east, Texel, Vlieland, Terschelling, Ameland en Schiermonnikoog. The English name for these five islands are the West Frisian Islands, but because of the used literature refers to them as the (Dutch) Wadden islands, I find it appropriate to do as well. The islands are not really isolated anymore. There is a ferry that goes multiple times a day, a lot of children from the island go to high schools and universities in the mainland and the Wadden islanders are a popular vacation spot for Dutch, German and English tourists. But thanks to this increase in tourism and the presence of national media, many islanders feel that their own culture is under pressure (Van Ginkel, 1995). Although the Netherlands is only a small country, cultural barriers, however, still exist within our nation (Suurenbroek, Schrover 2005).

According to Stengs (2011), thanks to processes of mundialization and Europeanization, the need for local, regional and national unity and the celebration of own identity has seen a rise in the past decennia. Cornips and Stengs (2010) add that economic growth, more leisure time, and more mobility, both in Holland and the rest of Europe, also have contributed to the rise in celebration of 'forgotten' locale festivities. Kootstra (2013) adds, "in this time of mundialization in which islands, cultures and nations discover or rediscover their identity, the image of the island is being treated as a part of the process of presentation and representation" (pp. 51). They choose festivals to celebrate their identity because "a festival performance serves the purpose of the articulation of the group's heritage, it is a communicative situation actively engaging participants, presenting a combination of participation and performance in a public context" (Kuutma, 1998, pp. 79). With this combination, the islanders simultaneously derive meaning from and give meaning to the festival, through cultural performances (Ginkel, 1995).

So these festivals and traditions are not only essential to the formation and retainment of their local Wadden islander identity (Ginkel 1995), but also plays a crucial role in how the image of the island is formed, how it's being represented and how 'outsiders' view their culture. To study how these festivals are being represented, this paper will analyze mainstream contemporary cinema - through which we can analyse this representation and view of the Wadden islands and their traditions. In particular, it will focus on the tradition of Sunderklaas or Sunneklaas, an annual winter tradition on the Wadden islands. To prevent confusion: although the name sounds a lot like the Dutch mainland tradition of Sinterklaas, the two are very different and have very little in common. Sinterklaas is in no way important for this analysis, but Sunderklaas is. Let us look what this tradition entails.

Sunderklaas, although known by different names on the islands, is a festivity that has been celebrated for a long time on all the island, with the exception of a small time on Texel, when Sunderklaas was forbidden because it seemed pagan (Jansen, Oostendrop 2004). On the 5th December (Texel on the 12th of December) men (and sometimes woman) walk the streets masked and dressed up. On some islands, events of last year are being re-enacted in a satirical way, on others, masked men roam the streets. They are in charge and anyone who isn't male or above the age of eighteen gets beaten home. One of the key elements of the festival is anonymity. Later on the evening, 'players' reveal themselves in local pubs (Jansen 2005). During this time of celebration, the islanders want to be exclusive among other islanders and often use their own dialect to strengthen and emphasize this 'islander bond'. This gives the whole tradition an air of mystery and misunderstanding, since we, outsiders, can't observe what is going on.

In this case study, I'll close read the 2015 television horror/thriller movie *Sunny Side Up* (Blok, 2015) to analyze how the Wadden islands and its traditions are represented in contemporary (horror) cinema. First of, we have to address the fact that only by using the Wadden islands and its traditions as a grim decor for a thriller movie, the movie makes a very clear statement about how we as a society view these practices. Although it sounds very obvious, Kirby (2003) makes an important statement when he claims that "the goal of a horror film is to incite fear in the audience" (pp. 241). He continues:

"Filmmakers will maximize the potential filmgoers by choosing fearsome elements that are recognizable as "treats" by the largest number of people. Therefore, we should be able to examine the treats in horror movies in order to learn about the subjects the general public experience as "frightening" (Kirby, 2003, pp. 215).

It's this reason that it's important to analyze the representation of the Wadden islands and the Sunderklaas tradition because it will give us an indication as to how we, as 'the mainland', uphold a certain frightful image of this tradition.

According to Kirby (2003) fear in a horror movie is elicited by "a monstrous treat in a stable situation" (pp. 241). Although mainstream (print) media have generally put this 'monster' label on the Sunneklaas festivities, with headlines like "On Ameland they don't want you to know they are celebrating a weird party" (Vice 2011), "the devil of Ameland" (National Geographic 2014) and "The Sint Secret: hunting on women with sticks." (Volkrant 2011), in this case study, however, I'll argue that it's not the islands and the Sunderklaas tradition, that's the "monstrous" treat, but rather the invasion of mainland imagery of the tradition that is corrupting this "stable utopian situation" that we find on the Wadden islands.

Consequently, I'll analyse the presence of this ambivalent representation of islands, dystopian hell or utopian paradise, in our island imagery. This ambivalent vision is found although the history of island imagery. For example, Isleifsson (2011) writes about the Medieval image of Iceland and Greenland: "that there was ambivalence about these islands, an incertitude about whether they were dystopian hell or utopian paradise isles. Although islands, in general, had a special status that made them suspect - either as wondrous or evil - it is likely that these islands were prone to these two divergent attitudes because they had a peripheral status and were situated in the far North. Writers living in civilized Europe could project a variety of opposites onto the unseen far North: good or bad, rich or poor, civilized or barbarian. The duality of being islands and being in the far North put these countries within a complex matrix of otherness.." (pp. 41). I'll argue that this duality representation can still be found in modern island imagery and by extension, the next case study of the movie *Sunny Side Up* about the Wadden islands.

"Where are we going? The year 1950," jokes Judith when she tries to set up the TomTom in the car. She and her boyfriend Daan, the two main characters of *Sunny Side Up*, are driving on the Afsluitdijk, toward the Wadden. An aerial shot reveals the setting of the road; surrounded by water. The shot hints at a certain isolation, and the road seems almost island-like. It draws parallels with aerial shots of islands that we are used to, surrounded by water and defined by its geographical borders, but also indicates a certain direction. Because there is, quite literally, only one way to go: forward. This gets emphasized by Daan: "We can only go one way," he says, when Judith finished setting up the car navigator. This forward motion, a representation of the ideology of the progressive couple from the liberal city of Amsterdam, is a notion that we later see contrasted by the conventional, traditional islanders. At the same time, this image of a road in the water suggests a certain break of isolation, an intrusion even maybe. Even though this particular road doesn't take us straight onto the Wadden Island, it tells us that is easier than ever before to cross the sea. It debates the idea of an island, its 'islandness' and its isolation in the 21 century. After all, what is an island, if you can just take a car to cross the sea?



(*Sunny Side Up*, 2015)

Sunny Side Up tells the story of a young couple, Daan and Judith, who drive up to the Wadden to stay in the vacation home of Eric, Judith her boss. Although it's never specifically stated in the movie to which of the five islands there are actually going to, in turn adding to the generality of the Wadden region, according to the description it's taking place on Terschelling. The movie focuses greatly on the relationship problems Daan and Judith are having, which I only will address, would the scene/event relate to this analysis.

Daan en Judith are the only people on the ferry to the island. The 'islandness' of the location is emphasized by a shot of the island border clouded in the mist. It looks mysterious, almost forgotten. This "mediation of perception across the border" has been a central part of Western representations of (tropical) islands, Riquet (2014) claims (pp. 134). He continues "the island emerges as an aesthetic object when imagined from the far side of this border" (pp. 134). On the boat, the two learn that 'Sunderklaas' takes place this weekend. A festive day during when, they learn in the car, "men are the boss and women and children aren't allowed outside at night or they risk getting beat up and send back home." Combined with the empty boat, an ominous sign.



(Sunny Side Up, 2015)

We get to see the island through the use of wide shots and tracking shots, emphasizing the emptiness of the location. Except for the car Daan en Judith drive in, there is not a soul on the island and all the shops are closed as well. This notion of being in 'the middle of nowhere' is emphasized by the isolated home the couple stays in and the sound of sheep in the background, confirming the rural identity the movie subjects the Wadden islands too. The first encounter with the islanders is a kid with a monster mask. Although he looks threatening, he is passive and it's actually him who has to fear. He almost gets run over by Daan and Judith.



(Sunny Side Up, 2015)

During the evening, they hear a noise outside. In the dark are standing two young islanders up the dike. They're being filmed with a high angle shot, suggesting they are the dominant force in this scene, and thanks to the darkness, their intentions are unclear. Daan, on the other hand, is standing lower and is quite visible in the light of the house. With big eyes he looks up, like a deer in the headlights, unaware of the danger. The two guys walk down the hill and with a soft, but slight treating tone they tell Daan he could 'better go home'. "We are having a party," he tells them, which emphasized the difference between the 'mainlanders', who are clearly excluded, and the islanders. There is us, and then there is them. Eventually, they disappear in the night.



(Sunny Side Up, 2015)

This is the second representation of an islander we see in the movie. In both instances, the representations have looked quite treating. The islanders don't seem very happy about the presence of outsiders during this time of local celebration. Daan and Judith ignore the warning, but the next day they are yet again confronted with a different set of social rules; there not allowed to buy more than one six-pack in the supermarket and while they are inside, their car mirror gets bashed in. Yet again, confrontation. The islanders and their traditions are being represented as violent, hostile and different to the 'mainlanders'.

Later that night, after a fight, Judith angrily walks away to a pub in the village. Although at first she's met with some distance, she gets served like anybody else and even gets drunk with some islanders. This whole terrifying image of the festival seems to be a facade, a cultural mask. This notion is emphasized of a shot of the kid with the monster mask, who was earlier almost run over. He is walking around without wearing it, suggest that although the tradition might seem frightening, underneath, it's just an innocent masquerade.



(Sunny Side Up, 2015)

Little before five everybody in the pub is putting on their masks. A suspenseful type of music starts playing and Judith decides to walk homewards, but she gets followed by Mick, the guy who the other night told them to go home. Outside, it's dark and in the distance, the sound of a horn can be heard. The islanders and their tradition are yet again represented as fearsome in the movie, but it's the mainlanders who turn out to be the hostile ones.

Mick guy offers to take Judith home on his scooter, but she declined. He tells her that "woman aren't allowed outside after five o'clock, so this isn't really smart of you." After several times politely asking Judith to get on his scooter so he can take her home, Judith gets enough of him and starts yelling that he has to 'fuck off'. He stops and he disappears in the dark background while seemingly putting on a mask. With putting the mask, he assumes his 'tradition identity'. All the streetlights turn off and he starts chasing her on her scooter.

Daan, looking for Judith in his car, sees Judith getting grabbed by the guy in the mask. He waits for a moment and then intervenes. The masked guy holds up his hands in peace when Daan tries to push him. He doesn't get violent at Daan at all and the couple quickly jump into their car, but while trying to drive away, they hit Mick, killing him instantly. An invasion of outside forces, in this case, the mainland, was the (literal) death of the indigenous culture.

After this they hide the body, hide from a passing masked group with torches and go home, Daan locks up Judith to prevent her from calling the police. He eventually lets her out but when she wants to walk away, there is a huge group of masked men at the door with torches. They seem threatening, but when Daan lets them inside (against Judith's wishes) they just playfully annoy her a bit but aren't really treating and hostile at all.

This changes when we see Daan standing outside and then entering the house with Mick his mask on. Mick's islander friends, not knowing he's dead, think it's him and he's cheerfully greeted. When he's standing in front of a frightened Judith, he gets a 'roede' and starts hitting her, repetitive and increasingly harder, until the other islanders around him stop him. They take off their masks, humanizing themselves and exposing their innocence, and drag Daan away, still thinking it's Mick, who is still angrily waving his 'roede' in madness towards Judith.



(Sunny Side Up, 2015)

He calms down, waits in the doorway till there all gone, closes the door, forces Judith on the couch and rapes her while still wearing the mask. The masks make him a different person or, at least, the false sense of anonymity enable him to act out on his frustrations. Finally, Daan has some (false sense of) control over his life, the situation, and his girlfriend. The mask gives him power over his reality and subsequently, he stops raping Judith when she pulls the mask from his face.

The movie ends with the two leaving the island. Accompanied with the same empty tracking shots of the island and distance shots of the island in the dark, with only the lighthouse as a beacon of light and civilization. The island still looks mysterious. We see a shot of a lonely boat in the distance and in the next shot we see Daan and Judith yet again sitting in isolation on the boat.



(Sunny Side Up, 2015)

Although the island festival was first represented as alien, treating and even dangerous, this was just an image of the reality of the couple from Amsterdam, a city, who in this context, plays the role of the progressive mainland. In the end, it's not the Sunderklaas festival who is a threat, but the invasion of the mainland. Daan almost runs over a child with his car, kills Mick with his car and attacks and rapes Judith while wearing a Sunderklaas mask. The rituals only take on a hostile form, when they are embodied and infiltrated by Daan (the mainland). The festival itself never gets aggressive or dangerous but gets corrupted by the presence of islanders. Or, as Riquet (2104) puts it while describing King Kong "the ceremony has been spoiled because the film team has seen it" (pp. 146). This representation of the Wadden and Sunderklaas by the mainland, turns into a negative representation when mainland media "join" the masquerade, by "putting on" the mask and make it something to fear. The invasion of the mainland (media) into the imagery of the island, make the tradition a hostile one.

The island, as an isolated notion, however, is emphasized during the film by the main characters who seem to be on their own 'islands'. They are isolated from each other, they are a lot in the car, which is an isolated location of itself, driving through an empty island, there are staying in an isolated house, they are isolated from the local culture and festivities. The island, as location, seems to contribute to this representation of emotional and physical isolation and alienation. This association between island and isolation contributes in turn to the image of the "islandness" of the Wadden islands, but at the same time, it undermines the idea of connection derived from the Sunderklaas festival. By emphasizing the alienation and not the connection when representing the Sunderklaas festival, it is made to look like some sort of grotesque cultural incident. Something to be feared.

Incidentally, I want to argue, this fear in turn fulfills the initial meaning of the tradition - to create a bond among islanders. And, to draw a parallel between the criticism of the Sinterklaas en Sunderklaas tradition, you see that when people's traditions are getting criticized, in defense of it, people come closer together. It, in turn, strengthens the idea of it's us against them and in some way and to some extent, I believe, the Sunderklaas tradition would be, in some way maybe, less effective, if mainland media didn't portray it as 'monstrous'. By trying to break down the mystery, they have made it more powerful for the islanders to identify with the islander identity.

In the end, *Sunny Side Up* is a film about how isolation creates stability and an invasion creates chaos. It's a movie about how we fear the unknown and how we fear estrangement from the known. But above all, it's a movie about control and power over reality. This brings us to the difference between festival and ritual: "festival explores and experiments with meaning, in contrast to ritual, who tries to control it" (Stoeltje, 1992, pp. 262). The islanders try to explore with the festival what it means to be an islander while we represent it as a conservative ritual.

In conclusion, this case study reveals yet again the combination of fear and fascination found in island imagery. We want to see the unknown, but also, be afraid, turning our representation of the island (in this case the Wadden) into "a pre-packaged and ambivalent vision of the island as paradise/hell" (Geiger, 2002, pp. 116). This image is constructed by the mainland and draws many similarities with what Isleifsson wrote about Medieval representations of Iceland and Greenland: "representations of these two countries in this period are mainly composed outside these two islands and coloured by the views of the "civilized" world." (Isleifsson, 2011, 42). A good thousand years later and the mainland still upholds this duality - this ambivalence between paradise and hell - when it frames and represents islands in imagery.

This duality - a black and white image - strengthens, in turn, portrayals of identity, bonding, islandness and being an islander. Since all these concepts in the traditional sense come forth of the 'we'/'us' feeling. This feeling is being strengthened by ambivalent representations, still regarding islands as places of isolation. If we want to move away from these classical representations and ideas, and usher in a new way of island representation, in accordance with their real world importance, connectivity and fluidity, we should try to develop new ways to visualise a modern understanding of islands. We should analyse representations of different islands and island groups and look if we can pinpoint this ambivalent representation and raise the question if this Medieval view is how we want to portray islands, the islanders and their way of life.

Islands: The West Frisian Islands

Title: Sea level rise and the West Frisian Islands, on the freshwater supply and the ambitions of five Dutch islands

Author: Henk Cornelissen, 10655441

Course: Islands, UvA

Date: 29-1-2016

Amount of words: 3243

Introduction and Relevance:

Off the coast of the Netherlands, Germany and Denmark is a string of islands located that stretches for over 450 kilometers and are named the Frisian Islands (figure 1). Because of the length of the archipelago the islands are divided into three groups; the Western (Dutch), Eastern (German) and the Northern (Danish) Frisian Islands. The area between the islands and the mainland holds the world's largest unbroken system of intertidal sand and mud flats and is known as the Wadden Sea (Bungenstock, 2010). Its ecosystem is dependant on the changes of the tides and is as such considered to be one of the most distinctive ecological systems of Europe (Bungenstock, 2010).



Figure 1: Location of the Frisian Islands in North-Western Europe (ArcGIS).

This Report limits itself to the Dutch Western Islands to reduce the scope and to be able to provide a more focused outcome. Another reason is that few scientific papers are written on the Frisian Islands as a whole and thus the larger part of specific information is found in domestic articles. This language barrier limits the information to English and Dutch sources.

The main research question of this report is “How does sea level rise affect the use of groundwater of the the populated dutch Frisian Islands?”. Before the research question is covered, the formation of the West Frisian Islands is put into context as well as groundwater in general on islands. To assist answering the main research question five subquestion have been devised. A conclusion will summarise results of the subquestions and provide an answer to the main research question. The subquestions are:

- What are the projections of Sea Level Rise models
- How are seawater levels and freshwater lenses correlated
- What is the future effect of precipitation on freshwater lenses
- What is the effect of groundwater extraction on freshwater lenses
- What is the role of fresh groundwater in relation to the ecology of the islands

Defining what constitutes to an island is a field of study that does not hold a single, universally accepted meaning. The definition of an island is mostly dependant on what the purpose of a study is, for which a specific definition is chosen. The general qualifier is ‘a body of land surrounded by water’ (Wong, Marone, Lana and Fortes. 2005). A supporting factor that is used to define what constitutes to an island for this report is the tidal effect. Due to tidal effects the definition is supplemented with: ‘a body of land surrounded by water *at high tide*’. When this definition is assumed a total of 13 isles constitute to the West Frisian Islands (VisitHolland, 2015). Of these islands five are permanently populated and are subject of the report, as the remaining eight are too small in area to hold fresh groundwater (Falkland, 1991). This results in the final definition in this report, an island is: ‘a *inhabited* body of land *containing groundwater* surrounded by water *at high tide*’.

The five populated islands of the West Frisian Islands are named: Texel, Vlieland, Terschelling, Ameland and Schiermonnikoog, from west to east. The isles have little altitudinal variation as shown in figure 1. As shown in the figure, the islands are partially lower than the sea level, these areas are prevented from being inundated through a system of coastal protection structures (Vries, 2016).

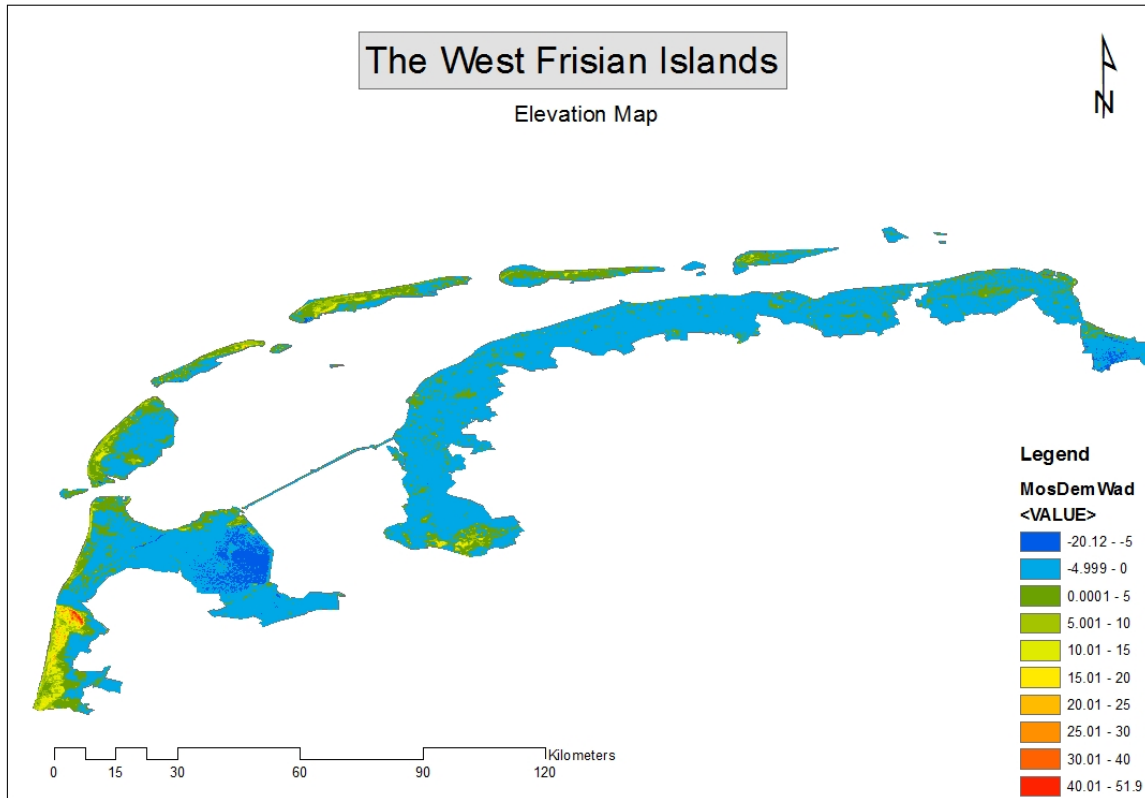


Figure 2: Elevation map of the West Frisian Islands and the Dutch mainland (ArcGIS).

Context:

The Formation of the West Frisian Islands

The formation of the western Frisian Islands took place some 5.000 years ago when the accumulation of sediments exceeded the sea level rise of that time. Sediments could accumulate by way of tidal action, due to the rapid sea level rise of before 5.000 BP no island formation occurred (Oost, 2012). The formation process was dynamic in the sense that the deposition of sediments was not consistent, both spatially as well as temporal. Eventually the process reached an equilibrium between sediment deposition and erosion by sea currents (Oost, 2012).

Initially the Western and Eastern islands were located more offshore than at present. This is the result of landward movement of the islands at a rate of 1 to 2 meters per year since formation. This movement is caused by the erosion of the seaside by the currents of the North Sea. At present day this movement is halted as vegetation provides structural against water erosion (Oost, 2012). A disturbance of insular ecosystems could lead to a reduction of protective vegetation and thus a landward migration of the Frisian Islands in general.

The western Frisian Islands consist of five distinct parts that are the result of the formation processes. The sea current of the North Sea flows eastwards and deposits sediments on the head of the island. Behind the island head an area of dune arcs are formed by aeolian processes. These dune arcs provide protection against sea erosion and human settlements can be found here, examples are the towns on Terschelling, Ameland and Schiermonnikoog. Eastwards of the dune arcs the tail of the island occurs in decreasing width. The final part is the shoreface and forms a beach on the northern side of the island (Oost, 2012).

The barrier effect of the Dutch Frisian Islands

The Dutch Frisian Islands form a natural barrier as the string of islands protects the northern mainland of the Netherlands from erosion by the North Sea. A lack of a natural or manmade barrier system allows for sea currents and occasional storms to gradually erode edges of land. This effect could potentially pose a threat to infrastructure and humans on the mainland (Mimura, 2013).

A secondary effect of the barrier islands is zone between the islands themselves and the mainland. This area is known as the Wadden Sea, whereby it is rather a vast tidal plain than a 'sea'. The plain is drained and refilled with seawater by tidal action and these circumstances provides an unique ecosystem and thus ecologic and economic value (Eriksson, 2010). A diminishment of the barrier effect of the islands would disturb the local ecology.

Groundwater on Small Islands

Groundwater is an essential source of freshwater for many societies as groundwater is in general reliable, filtered through soils and abundant (USGS, 2016). Through mainly precipitation the global volumes of groundwater are replenished and, depending on local circumstances, flows either underground or through rivers to lower areas (USGS, 2016). This principle of groundwater movement and replenishment is applicable on small islands, though surrounding seawater leads to some different conditions compared to continental situations.

The origin of groundwater on small islands begins with precipitation and is thus dependant on climatic factors. A 'lens' of freshwater is spatially in equilibrium with the surrounding seawater because of the difference in density of salt- and freshwater. The density of freshwater is around 1.000 kg m^{-3} and compared to the density of saltwater (around 1.025 kg m^{-3}) it can float on saltwater (Kok, 2007).

This physical difference leads to conditions that are unlike those of the mainland and means that climatic changes and human actions have different effects on groundwater systems on small islands. Pressure of the mass of saltwater of the sea forces the fresh groundwater to the surface of an island, without a counteracting force the accumulated groundwater would readily diminish (Kok, 2007). The force that opposites the water pressure of the sea is the surplus of rainwater. The constant influx of freshwater into the ground balances both processes (Kok, 2007).

This equilibrium leads to the Ghyben-Herzberg principle and gives an estimate for the length of the groundwater column (Kok, 2007, Masterson, 2013). This length is based on two values, the depth of groundwater below the the sea level and the height of the groundwater lens above sea level. These two lengths are dependant on each other and are based on on the density ratio of salt- and freshwater.

A density ratio of 1.000 to 1.025 results in a 40 meter to 1 meter length ratio (Kok, 2007). For a groundwater lens that extends one meter above sea level the groundwater column extends for forty meter below sea level (Figure 3). However, this theoretical height ratio is seldom found as the soil under small islands are not homogenous. Layers of clay and peat impede the principle of Ghyben-Herzberg, on the Frisian Islands a groundwater ratio of 25:1 is generally found (Kok, 2007).

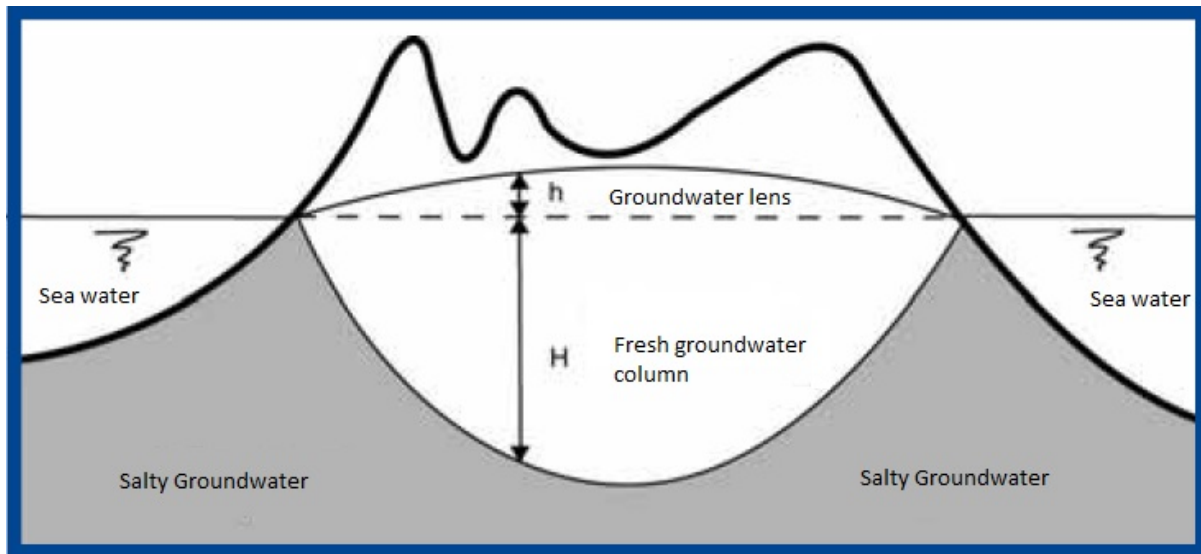


Figure 3: Illustration of the Ghyben-Herzberg principle (Kok, 2007).

Research Questions

What are the projections of Sea Level Rise models

A report of the Intergovernmental Panel on Climate Change (IPCC) of 2014 made four scenarios on global sea level rise for the course of the future until the year 2100 (IPCC, 2014). The best case scenario is RCP2.6 and projects an average global sea level rise of 0,45 meter in 2100. The worst case scenario is RCP8.5 and predicts a rise of 0,75 meters in 2100. Both scenarios conclude that the global average sea level rise will vary between 0,20 meter and 0,25 meter for the coming 35 years. The difference in scenarios mainly depends on how the course of human emission of greenhouse gasses develops. (IPCC, 2014).

Another projection was made by a panel of Norwegian climatologists and conclude with scenarios that have a wider range in estimates than the IPCC report has. A rise of global sea level is reckoned to vary between 0,09 meter and 0,88 meter by GRID-Arendal (Church, 2011). This centre cooperates with the United Nations Environment Programme and not affiliated with the IPCC. The projection of GRID-Arendal depends on future emissions by humans of greenhouse gases as well (Church, 2011).

The projections made by the IPCC may be too conservative according to Bellard et al. (2013), the reason that is put forward is that the IPCC do not account for the melting and sliding of land ice in Greenland and the Antarctic. A model by Overpeck et al. (2006) concludes with a worst case scenario that peak rates of sea-level rise are conceivable that exceed one meter per century. This disconcerting possibility is based on the prediction that the consequences of melting processes in the Arctic and Antarctic are not well comprehended with current scientific documentations (Overpeck (2006).

To conclude these divergent projections the exact rate of sea level rise the coming decades is unknown. Factors such as to what extent humans continue to emit greenhouse gases is dependant on unpredictable (anthropological) factors. Other effects such as ice sheet melting and sliding of the Arctic and the Antarctic require further scientific attention before accurate predictions can be made. In the end politicians and legislators of small islands make policies based on science and economics, the lack of scientific advice on sea level rise should not lead to an underestimation of the effects of sea level rise.

How are seawater levels and freshwater lenses correlated

One of the most common perceived consequence of sea level rise is the inundation of coastal areas. As most human cities are located in or near coastal areas a small rise will greatly increase the risk of seasonal or permanent flooding (IPCC, 2014). To mitigate the increase of risks, investments in coastal protection structures need to be made (Mimura, 2013).

Another consequence of sea level rise is the potential diminishment of fresh groundwater for ecological functions and for human consumption. As the total volume of groundwater under small islands is based on the Ghyben-Herzberg principle, a lowering in height above sea level of the freshwater lens will decrease the volume of groundwater.

As the height of the freshwater lens is relative to the sea level (Figure 4), an increased seawater level reduces the total volume of groundwater (Masterson, 2013). If the freshwater lens/groundwater column ratio of 1:25 is applied, a sea level rise of one meter will result in a decrease of groundwater column depth of 25 meters (Kok, 2007 & Masterson, 2013).

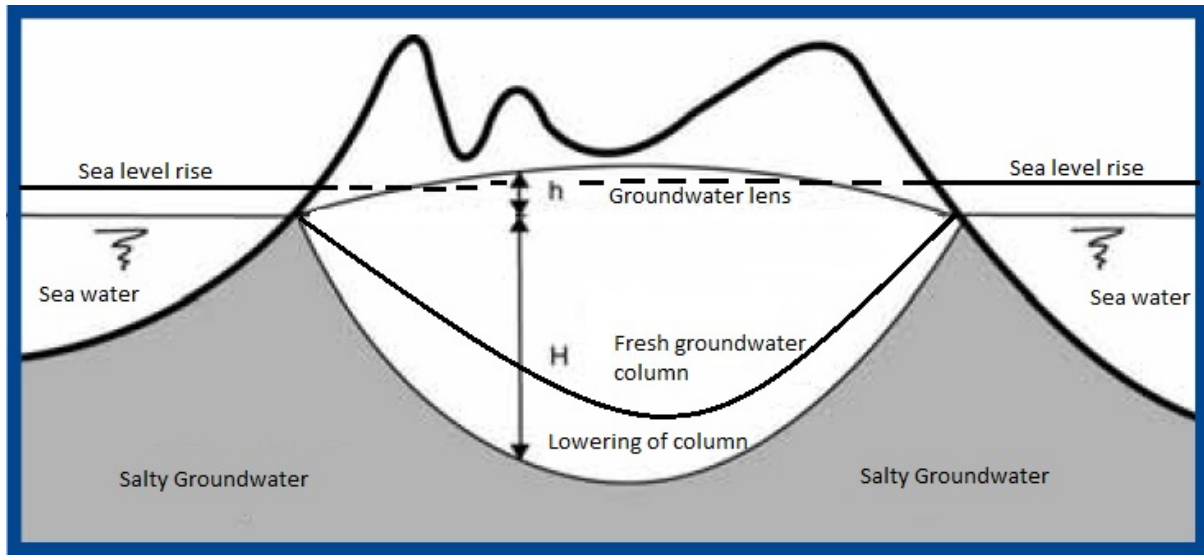


Figure 4: Illustration of the Ghyben-Herzberg principle in the relation to sea level rise (Kok, 2007. Modified).

What is the future effect of precipitation on freshwater lenses

The height of freshwater lenses of small islands, and thus its groundwater volume, is dependant on the surplus of rainwater. A lowering of precipitation rate or an increase of potential evaporation decreases the rainwater surplus. Projections on changes of both factors were made by the Royal Dutch Meteorological Institute (KNMI) for the Netherlands. A 2014 report designed four possible scenarios for 2050, the conclusion of the report is that due to increased temperatures and a decrease in rainfall an increase dry periods is expected (KNMI, 2014).

No specific figures are given by the KNMI on the West Frisian Islands and so no precise calculations can be made in this report on the effects of rainfall reduction on the volume of groundwater of the West Frisian Islands. Rather a general assumption is made that the decrease of future rainfall will negatively affect the availability of fresh groundwater on the islands. Figure 5 provides a precipitation map for 2014 (KNMI, 2014, ArcGIS, 2016).

Accurate predictions on the change in potential evaporation are lacking as well. However, a modest decrease in the intensity winds is expected as a continuing effect resulting in a minor reduction in potential evaporation (KNMI). This in turn is negated by an expected increase of solar intensity as more solar heat allows for more surface water to evaporate (KNMI). As a conclusion the future groundwater volumes are expected to decrease due to the climatic changes.

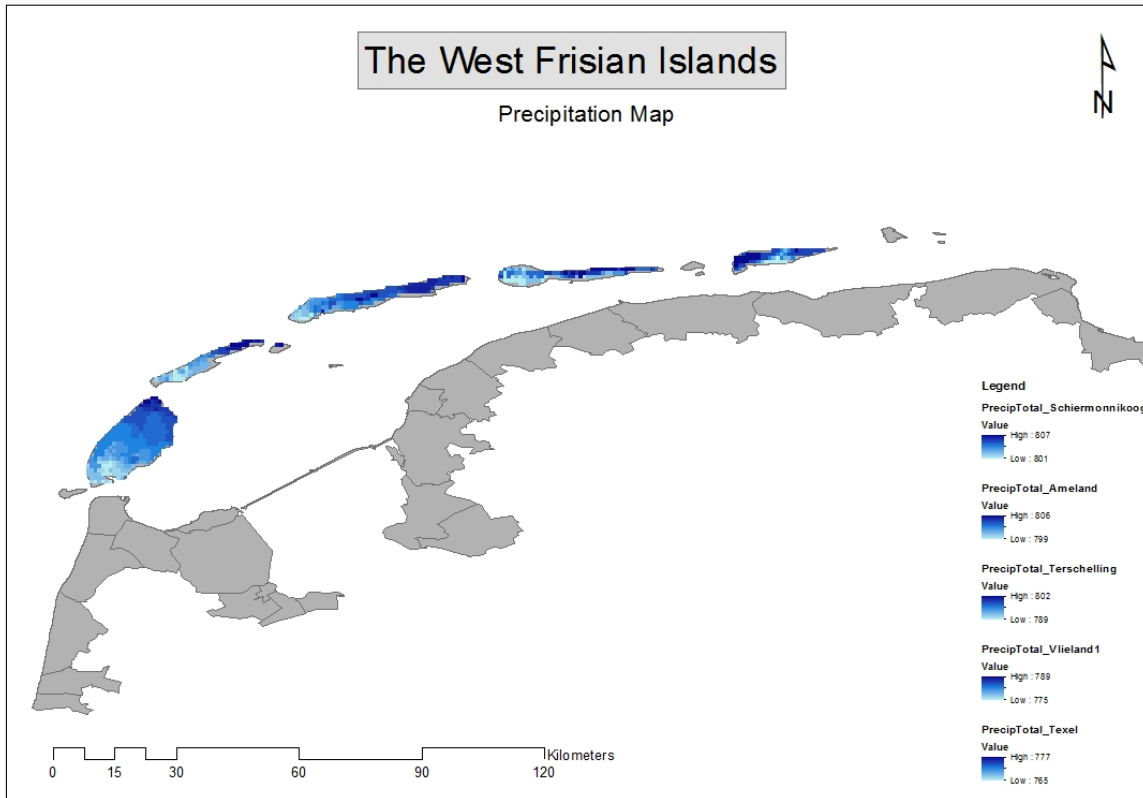


Figure 5: Precipitation map of the West Frisian Islands and the Dutch mainland (ArcGIS).

What is the effect of groundwater extraction on freshwater lenses

In the year 2007 the five municipalities of Texel, Vlieland, Terschelling, Ameland and Schiermonnikoog set the objective to be fully self sufficient in 2020, this ambition is focused on energy and freshwater supply (Suurmeijer, 2007). By pumping up freshwater for human consumption the islands plan on being able to become independent in terms of freshwater of the Dutch mainland. This, however, puts another strain on the groundwater level and volume.

The islands of Texel, Terschelling and Ameland are dependant of freshwater on the mainland (Peters, 2013). Texel requires $1.600.000 \text{ m}^3 \text{ y}^{-1}$ and is fully dependant on the mainland. Terschelling and Ameland require 560.000 and $530.000 \text{ m}^3 \text{ y}^{-1}$ respectively, of which a third is provided through groundwater sources. The islands of Vlieland and Schiermonnikoog both require $190.000 \text{ m}^3 \text{ y}^{-1}$ which is fully provided by the groundwater supply. Though a system of pipes freshwater can be transported from the mainland to the isles (Peters, 2013).

As tourism is an important element of the Frisian economies any variation in the number of tourists affects the amount of freshwater that is required (Suurmeijer, 2007). As it is the desire to expand the tourism sector of the islands by the municipalities the need for freshwater will thus increase. Both trends of becoming more independent in terms of freshwater from the mainland and to attract more tourists to the islands leads to greater pressure on natural freshwater resources.

What is the role of fresh groundwater in relation to the ecology of the islands

Terrestrial flora and fauna are generally directly dependant on freshwater sources for survival. The primary producers of a terrestrial ecosystem are plants such as trees and grasses. These plants depend on groundwater to absorb and utilise freshwater for biochemical processes. Most terrestrial plants do not have mechanisms to utilise saltwater and will thus die in the event of groundwater salinisation (Eriksson, 2010).

A lowering of the freshwater lens will lead to a decrease of ecological resilience as a salinisation of groundwater has a harmful effects on plants. Being the primary producers, a diminishment of plants would result in a spiral of decline that affects all layers of local ecosystems (Kier, 2009). The effects of a decreased groundwater level would be most noticeable at the edges of an island as these areas have shallower groundwater levels than the centre of an island (Figure 4).

One of the functions of flora on small islands is the structural protection it provided against erosion. This function is most crucial at the edges of islands such as the Frisian islands as dunes are a main barrier against erosion forces caused by winds and the sea (Eriksson, 2010). A loss of vegetation on the West Frisian Islands would thus lead to higher rates of erosion.

Another function of flora and fauna is that the unique ecosystem of the Frisian Islands attract, mostly domestic, tourists and provide thus an economic boon for the local economies (Eriksson, 2010). The preservation of the ecosystems is paramount for both ecological as well as economical reasons.

Conclusion

The Dutch inhabited Frisian Islands are at risk of being confronted with increased rates of erosion. This prediction is based on a multitude of factors that are unique for isles such as the West Frisian Islands. These 'inhabited body of land containing groundwater surrounded by water at high tide' are naturally protected from coastal erosion by terrestrial vegetation. One of the requirements for land-based plants is the access to fresh groundwater, therefore a salination of groundwater leads to a diminishment of vegetation.

Fresh groundwater resources on islands differ from those on continental settings as the volumes of freshwater float on saltwater. Caused by a difference in density this equilibrium is highly affected by sea level fluctuations. The projected rise of global sea level will lead to a vastly reduced volume of groundwater under the West Frisian Islands, though no accurate estimations are available on this diminishment.

Further reducements of the volumes of groundwater are through predicted reducements in precipitation, increased tourism and the direct extraction of freshwater for economic purposes. These factors may lead to a future erosion of the West Frisian Islands to an extent that the ecological system of the Wadden Sea becomes disrupted and more extreme influences of the North Sea to the mainland.

To mitigate the effects of sea level rise on the West Frisian Islands protective and preemptive options are available for implementation. Protective options consist of the construction of extensive coastal protection structures instead of relying on natural coastal protection systems. Preemptive options consist of maximising the volume of fresh groundwater to prevent a deterioration of natural coastal protection systems.

Man-made coastal protection structures requires investments by mainland sources. This investment by the mainland will prove to be a necessity if the islands' economies and the ecological systems of the Wadden Sea is to be preserved. The political goal of becoming self sustainable in terms of fresh water is not advisable. Rather the investment in high-quality and long-lasting pipes to supply the populations and economies with freshwater is advised, as becoming self sustainable is not a sustainable option for the West Frisian Islands.

Discussion

Western societies and therefore its politicians are swayed by trends and the current trend is to be 'green'. By becoming self sustainable the author of this report thinks that islands try to increase their image so as to attract more tourists to the islands. While not necessarily a negative development, in this situation this goal may not prove to be an economic viable if the future (a multitude of decades) is taken into account. These changes in goals can be applied to islands similar to the West Frisian Islands. Even if the Frisian islands would step away of being independent in terms of freshwater supply more coastal protection structures are needed to counter the effects of climate change, if not for this century, than for the next.

Chapter discussion and conclusion

In this final part of the chapter we like to discuss the lessons we think can be learned from our research. We also like to discuss, in contrast to the positive view of the 'Islands' course on interdisciplinary research, how this interdisciplinary view doesn't always contribute to the research or complement two very different papers.

The lesson that can be learned from 'The Horror Mask of the West Frisian Islands' is that we still project a very black and white image of islands - either as an utopian paradise or as a dystopian hell. The exact nature of the 'utopianess' or 'dystopianess' in question differs between groups who represent them like that and what they perceive as utopian or dystopian. Although further research is needed to prove the next prediction, I predict that this duality can be found in any form of island imagery. The case study shows that, on a high level, these are only two ways to look or talk about islands. This sort of extreme way to represent islands hints at the feeling that islands are isolated place and not connected to - or a part of - the rest of the world, since there are being viewed as the manifestation of one certain feature. So people won't be quick to view islands as the complex, fluid hubs of culture, nature and meaning that they are if they are constantly being represented like this. If we want to move forward in our way of thinking about islands, we have to address, discuss and maybe even try to alter the way they are being represented in imagery.

This contrast in representing small islands as two extremes is not compatible with the technical advice that is given in the second half of this paper. Unless some far-fetched theories are concocted to explain the direct relationship between the representation through the cultural imagery of the West Frisian Islands and the consequences of sea level rise on policies on freshwater utilisation, an attempt to produce an interdisciplinary product may not be deemed worthwhile.

Although the lectures of the Island course have numerous times shown how an interdisciplinary look at islands is a beneficial method to look at islands, we like to look at our chapter as an example of how this is, in fact, not always the case. Although the topics in this chapter concern the same group of islands, namely the West Frisian Islands, they are in no way related and can't really be combined to give us a bigger, better or broader interdisciplinary look at the West Frisian Islands. At first, the two subjects discussed in this chapter are very far from apart. While one looks at rising sea levels and surface water usage, the other looks at representations of island traditions in contemporary mainstream cinema. But not only are the subjects very different, the used method in the two paper also very differ.

Being culturally orientated, the study about island representations in media uses a qualitative way of looking at the subject. Arguments to support the claim are found in the analysed media text by using different methods from the cultural studies and particularly film studies. The conclusion mainly derives from, in some way, subjective claims and interpretations from the movie supported by literature written in a similar style. It's a very different approach from the other paper.

The study on why policies on freshwater production through groundwater extraction should be revised utilises a more technical based approach. The conclusion of this study is obtained by linking a multitude of different subject-specific studies so as to derive a broader outcome. The section reasons that as uncontrollable effects such as climate change influence the groundwater dynamics on small islands, human society should mitigate these effects by setting reasoned objectives. It is, however, the case that the objectives on groundwater extraction set by the five West Frisian Islands are attaching more value to modern, one-sided, 'green' paradigms than to rational, long-term, adaptable viewpoints.

One of the consequences of sea level rise is that vegetation on small islands may die off which can lead to the loss of natural integrity of islands. This is the result of the salinization of groundwater at the edges of islands that lead to the loss of structure-improving vegetation. Reductions in the input of new freshwater by climatic changes and increased extraction rates by humans amplifies the process of groundwater depletion.

These two papers are both useful in their own way and in their own line of academic profession. While the same research may very well be implemented in other islands or island groups to prove the same conclusions, they are not suited to be combined to support a constructive common conclusion. This, however, doesn't mean that interdisciplinary studies should be regarded as a fractured method, but should remind us of the weaknesses of interdisciplinary studies: not every field of study can be combined to be useful in an interdisciplinary context. That's not bad, but something to be aware of when considering an interdisciplinary approach. While it might strengthen multiple forms of research, it's practically useless for some others. But even if it doesn't aid your research at all, it might still be very interesting to try.

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Islands in the Malay Archipelago

Societies, development and hazards



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Introduction

South East Asian islands are the homeland to several nationalities and ethnic populations. The largest countries in this region are Malaysia, Indonesia and the Philippines, but in this chapter these three countries do not define the archipelago. Countries like Singapore, Hong Kong, East Timor, Brunei and more, are also part of the archipelago. The islands in this archipelago are together defined as the Malay Archipelago including Hong Kong.

The four researches in this chapter cover a very interdisciplinary approach on the establishment of society and nations in the Malay Archipelago. The disadvantage of researching these islands is that every island has it's own story, however, researching these islands can explain why other islands in the region did not developed in the same way. But more important the findings of islands in this area can be used to improve the facilities and policies on other islands.

In this chapter we will outline the establishment of religion in the Malay Archipelago with extra attention to Bali, since Bali's major religion is Hinduism while surrounding islands are mainly Islamic.

The development of modern societies in Hong Kong and Singapore covers multiple other interesting case studies of the Malay Archipelago, because both nations belong to the most developed countries in this region.

Hong Kong's nature conservation has accidently become one of the most developed ones in the world and is researched in detail in this chapter.

Singapore is world leader in water management, however the nearby island Batam is far behind in it's water management compared to Singapore. Meanwhile companies established in Singapore are retaining cheap labor and land in Batam but also polluting the island. The outlined findings of Singapore are used to develop better understanding of Batam's challenges and future perspective.

Finally one of the major (potential) hazards in this area: deforestation on Kalimantan is researched for better understanding of the impact of oil palm plantations, which belongs in the Malay archipelago to the major agricultural activity.

Together the researches form an overview of the society in this region and it's potential hazards.

Religion in Indonesia



Island: Indonesian archipelago & Bali.

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1. Introduction

The Republic of Indonesia is the country with the largest Muslim population in the world (Kristiyanto, 2013). But this was not always the case as there were many forms of traditional faiths and Hinduism was spread throughout the archipelago. But from the 16th century on the Islam almost entirely replaced Hinduism (U.S. Bureau of Public Affairs, 1989). Now around 85 percent is Muslim, eleven percent is Christen and about four percent are other religions including Hinduism, Buddhism and traditional faiths (Hoon, 2013). This shift was the result of trade with foreigners, and later on colonialism has had it influences as well. Moreover, it is important to note that Indonesia was not always the state it is now, it consisted of many small kingdoms. At the time this made conversion to other religions possible, as only the rulers of small kingdoms needed to be converted. And not the whole state. Eventually this resulted in most of the kingdoms to be converted to the Islam.

Except for the island Bali (see figure 1), here Hinduism is still dominant. This is remarkable considering that most surrounding islands are Muslim. Which brings us to two the central questions of this paper: how did Indonesia develop to become the biggest Muslim state in the world, and how did Bali remain Hindu. The contribution this paper can make to the already extensive literature is in the fact that while answering this question special focus will be on the fact that Indonesia is an archipelago, and how this has contributed to some of the developments that have occurred. So to what extent have characters of islandness played a role in the formation and distribution of religion. For example, has the surrounding sea isolated Indonesia or did it function as a bridge rather than a wall, thus has it connected the archipelago with the rest of the world? And was it more vulnerable because of its physical properties, or more resilient? In this new perspective, which takes islandness into account, lies the contribution of this paper. As the historical trends are examined with a link to the physical features of the archipelago. To be able to answer these questions the paper has the following structure. First there will be described how Islam has claimed its position as the most important religion. Secondly, we will zoom in on Bali and examine how this island reacted to external influences. The third section will reflect on how, both the entire archipelago and Bali, display traits of islandness and how this has influenced their development. And finally a conclusion will be drawn.



2.1 Current state of the Archipelago

The current state of religion, with a big majority of the Islam is the result of a complex developments that started in the 7th century when the first Muslim merchants arrived in the archipelago (Houben, 2003). This paragraph further described this process as the first part gives a historical background on how the Islam has found its way into the archipelago. Second, the current state will be examined with the aim to be able to foresee possible developments.

Two factors have made the Indonesian archipelago an attractive place for merchants and foreign influences. The first factor is the high amount of resources, this attracted Arab and Chinese merchants around the 13th century (Michalopoulos, Naghavi & Prarolo, 2012). The second is the strategic location of the archipelago, located between the Indian Ocean and the South Chinese Sea it has been a busy trade route (Laffan, 2013). In the 11th century Muslim merchants from India, Arabia and China introduced the Islam to the archipelago (Ricklefs, 1991), but it took a few ages for it to become the dominant religion. One of the causes of this gradual change was that at the beginning of the 13th century the trade routes became less used due to a fall of the strong Srivijaya kingdom. It was the conversion of several kingdoms that reinvigorated the trade with the Arabic world (Michalopoulos, Naghavi & Prarolo, 2012). And this might be one of the reasons for the kingdoms to convert, as the stronger religious ties resulted in more trade. The first kingdom to be converted was Aceh, the northern part of the island Sumatra and the most powerful kingdom in the region. In the 14th century it spread to eastern Java, but the western part remained Hindu and were hostile towards the Islam. Java is nowadays politically and economically the most important island. From then on the Islam spread over the archipelago, but not systematically from west to east. The spice producing island in the east, e.g. Banda, Ternate and Tidore, were under the rule of Muslim kings. Which can be escribed to the fact that the economically most important regions, were the first ones to accept the Islam as their faith (Ricklefs, 1991). These regions were located at the coastal areas (Laffan, 2013). This acceptance was a 'top-down' development were the rulers of a kingdom decided which religion his subordinates will follow. The division of Islamic coastal areas and Hindu hinterland resulted in clashes and sometimes wars (Ricklefs, 1991). With the arrival of the Portuguese colonists in the beginning of the 15th century Christianity was introduced in the region, which is currently the second largest religion of Indonesia. The policy of Christianisation was not successful at first as they encountered local opposition. But the eventually Catholicism grew from 10.000 in 1560 to 60.000 in 1590. This rapid growth changed when the Dutch arrived in 1595 and advocated for Calvinist Christianity. The Dutch were more tolerant towards the Islam. And in contrast to the Portuguese they did not encourage missionaries to convert the local people. They had a policy of non-interference in the local religions, they even prohibited Christian missionaries to visits some of the Indonesian Islands (Vandenbosch, 1952). But on some islands like the Moluccas Christianity was distributed and adopted. Meanwhile, new inventions brought in by the west facilitated the spread of the Islam within the Indonesian population. For example, the steamship made pilgrimages to Mecca possible with strengthened the ties with the Arabic world and between Muslims in Indonesia (Jonge & Kaptein, 2002). Another factor of importance was the emergence of printing which enabled the spread

of religious text to the general public, with more support as a result (Houben, 2003). The Islam was accepted by many, but strongly interwoven with local Hindu culture and much different per region. In the years of the Dutch colonists the Islam steadily acquired more followers, and now we take a leap to the singing of the independence in 1945. Because since this date religion would become more of a political issue or tool to form a unity or to act up as opposition. The stronger Islam grew stricter with the increased modernization, but was suppressed by President Suharto during his reign. In 1998 with the fall of Suharto the Islamic political parties proliferated and grew strongly now that the politics of suppression were lifted. Though, they were not able to acquire the majority of the votes which can be escribed to great division within the Islamic political parties (Houben, 2003). For example, the Muslims in the periphery where in the rule more orthodox in comparison to the Muslims on Java, with conflicts as a result (Houben, 2003). These developments resulted in the distribution seen in figure 2 which also partly visualises the radicalism of certain regions.

MUSLIM REACH Since 1998 many districts and some provinces have adopted regulations inspired by sharia—Islamic law. These range from banning alcohol and enforcing dress codes to compelling Islamic alms payments and requiring Koranic literacy. Critics say such rules subvert Indonesia's constitution, which ensures religious freedom for all.

In 2001 the government designated Aceh a Special Autonomous Region, allowing the province to implement sharia as part of its criminal code.

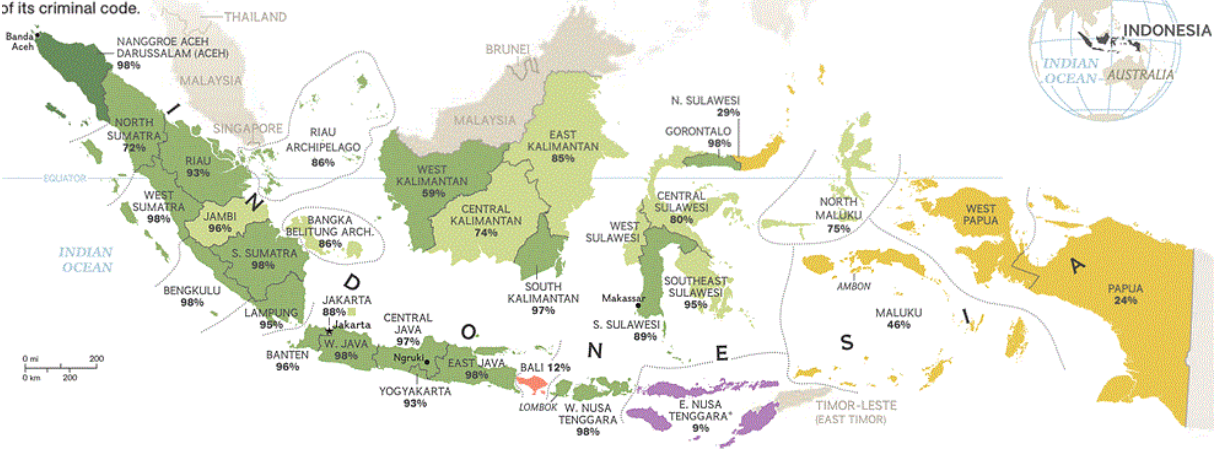


Figure 2, Religion in Indonesia and the Sharia (Buehler, 2005).

2.2 Current state of Bali

As can be seen in Figure 2, Bali is surrounded by Muslim islands but itself is still Hindu. This is mainly the result of three processes which this paragraph will further explain by giving a brief history, starting in the 15th century.

The first reason can be escribed to the fact that Bali was a peripheral area in terms of trade. As argued in paragraph 2.1 the zones that were most economically active were the first to convert to the Islam. As there was not much trade between the Balinese and Muslim merchants there was no incentive to become Muslim, and therefore it remained Hindu (Vickers, 1987). Second, Bali had strong cultural ties with the neighbouring island Java, there was a Javano-Balinese culture (Hooykaas, 1973). This

shifted when Java was converting to the Islam, while Bali fought fiercely to remain Hindu in the 15th and 16th century and succeeded (MacRae, 2011). As a result of the strong cultural ties with Java many Javanese aristocrats and priests fled to Bali, which further strengthened the religious bifurcation of the island (Vickers, 1987). The third factor that reinforced this divide were the Dutch colonists. In 1846 they commenced their contest to colonize Bali and they succeeded in 1908, this makes Bali the last colonized island (Picard & Madinier, 2011). Reason for the late colonization was that the Dutch did not see the importance of the island as it was economically peripheral. However, later on they recognized Bali's strategic value in its proximity with the economically and politically most important island Java (Howe, 2005). Also they saw it as an opportunity to contain the radical Islam that already manifested itself in Sumatra and Java (Picard & Wood, 1997). Upon arrival the Dutch and other Orientalists saw the cultural and historical uniqueness and were determined to help the Balinese sustain their religious independence, as they saw Bali is a 'museum of Hinduism', and associated the Islam with the destruction of culture (Vickers, 1987). In order to help preserve the Balinese culture the policy of 'Balineesering' was implemented which would help the Balinese to define their own culture. However this implicated that the colonists would help the Balinese define the culture based on what they, the Dutch, thought that the Balinese culture was (Howe, 2005). Part of this program was the education of the Balinese elite to counter Islamic associations that began to settle on Bali (Picard & Madinier, 1987). These policies partly resulted in the Balinese identifying their culture in what they were not. Thus, part their identity consisted of not being Muslim or Christian, and not so much in being Hindu (Picard & Wood, 1997). Consequently, questions can be raised if the Dutch succeeded in helping to preserve Balinese culture.

Despite this difference in religion the relations is not as straightforward and dichotomous as suggested above. In fact, there is a complex relation throughout history between the two religions. There were wars between the two religions, but there were, and still are Muslim settlements on Bali where the two religions coexist peacefully (Vickers, 1987). This brings us to the current situation on the island. Although it is still mainly Hindu there is an increasing number of Muslim immigrants. They are primarily from Java and are looking for work. This evokes concern among the Balinese as they fear a hidden religious agenda (MacRae, 2011). The bombings of 2002 in the city Kuta in eastern Bali resulted in a collapse of the Balinese tourist economy. Also the bombings, which were a Jihadist protest, were likely to add to the fear of the religious agenda of Muslims in Bali. The bombings were the result of increased tourism from Western countries, with prostitution and drugs alongside it. To radical Muslims this made Bali a sinful place, and thus a target (Bagus, 2010). The bombings reinforced the dichotomy of Hindu and Muslim population in Bali. Even though the bombers were not Balinese Muslims, they came from East Java. The division was also geographical visible as the western part of Bali, which is closer to Islamic Java, has a bigger share of Muslims. This, and the fact that the central rule is in eastern Bali make this region somewhat instable (Bagus, 2008). The religion on Bali has been shaped by a few foreign influences. Of these colonialism and the relation between tourism and terrorism can be seen as the greatest.

2.3 Reflection on Islandness

Islandness has played a role in both connecting as isolating the islands, this paragraph discusses to what extent the fact that these islands *are* islands has influenced their development. This is done by first explaining how it has connected the archipelago with the rest of the world and secondly how it has influenced it in other ways.

Indonesia was mostly Hindu before the arrival of foreign Muslim merchants. But their strategic location and resource richness made it an appealing place for traders. The strategic location is something where islandness plays a role. As they are surrounded by water it makes them easier to reach for ships, which are an important means of trade. So the whole archipelago is surrounded by water, this did not affect their connectivity in a negative way, rather it enhanced it. Because, for a Muslim merchant the sea was not an obstacle, it facilitated trade. Moreover, with the invention of new more efficient ships Western colonists saw it profitable to travel this distance too.

In addition, and specifically for Bali, the high degree of connectivity has influenced its development in another way. Although at a first glance it would be tempting to assume that Hinduist Bali is more authentic, and not influenced as much as the rest of the archipelago in their religion, I argue that this is not the case. For, the Dutch helped the Balinese in preserving their Hindu culture that they saw as a 'museum', but by assisting them they formed the culture as well. The policy of Balineseing of the Balinese was influenced by Orientalists, and so an outside influence was added to the Balinese culture. Next, this policy prevented the island from becoming Islamic and thus foreign intervention stands at the basis of the Hindu society of today, without intervention of the colonists Bali would most likely have become an Islamic island too.

On the other hand the island is more vulnerable to outside threats, this can be seen in the fact that after the bombings in Kuta the economy collapsed. Like Royle (2015, 9 December) said in his lecture on the politics of small islands specialisation can be a risky strategy. As Bali was very dependent on tourism the collapse, that was a consequence of the terrorist attacks, had consequences for the entire population of the island. Specifically to an island it can be risky to specialize because once this resource falls away, alternatives are sometimes not within reach, in the case of Bali this resource was a 'paradise for tourists'. Also the immigration of Javanese to the island has already a destabilizing effect, as religions might clash and the central rule finds it hard to include the western part of the island due to the dichotomy of religion and their connection with the eastern part of Java. This too emphasizes the fact that the small strait of water between the two islands is less of a barrier as cultural and religious differences.

In general, the fact that Indonesia is an archipelago and Bali an Island, have had influence on their development both in a positive as in a negative way.

3. Conclusion

To come back to the central question of this research: how did Indonesia develop to become the biggest Muslim state in the world, and how did Bali remain Hindu. This has developed in a way that can be ascribed to the fact that the archipelago has a long history of foreign influences. The strategic location between China and the Arabic world has resulted in a lot of ships passing by in the early centuries. Additionally, the high amount of valuable spices have attracted many merchants. These two factors were the

main reasons for foreign influences, one of which is religion, to be introduced in the region. They accepted these religions on the basis of economic interest, or were forced to by foreign colonists.

In Bali these developments were different. They were inclined to preserve their own culture, and thus rejected the Islam. This and the fact that Bali was peripheral when concerning trade, made it possible for them to remain Hindu. But slowly the Islam was growing in support, this is when the Dutch saw it necessary to intervene. They saw Bali as one of the only islands that was still traditional, this was a trait that needed to be conserved, for strategic reasons, and they introduced the policy of Baliniseering. With as a result that Bali has remained Hindu, but only in the shape that the Westerners thought was appropriate and original. But to this day there still are tensions between the Muslim and Hindu populations. This was reinforced by the bombings in Kuta by Muslims. Here we can see that islandness comes to play. As islands are attractive places for holidays, and in particular Bali, they attract many western tourists with other values. This and the specialisation on tourism have made the island vulnerable to culture clashes, but also to economic crises. As this paper mostly focusses on the historic developments of religion, further research could further explore the current situation of religion, and to what degree islandness will influence future developments. Thus, at the start of this paper I was interested in how the isolation of the archipelago has shaped the region. It was soon that I discovered there was no isolation. On the contrary, the region seemed, and still is more connected with the world because of the fact that it is an archipelago.

Nature conservation in China's economic heart, with a focus on the Hong Kong Special Administrative Region (HKSAR).



Name of archipelago: the Pearl River delta (focusing on Hong Kong Special Administrative Region (SAR))

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Introduction

The Pearl River delta is one of the most interesting archipelagos in the world. It is one of the most autonomous regions of China: two areas, Hong Kong SAR and Macao SAR, are even acknowledged by China to be Special Administrative Regions (SAR), including but not limited to having their own legislative system and having a high degree of autonomy (Hong Kong Special Administrative Regions Government, 2015). The Pearl River delta is even known to have its own language that is spoken way more than the Mandarin of the Chinese mainland in this area: Cantonese (Li, Wang & Sun, 2015)

The Pearl River Delta is very interesting due to the designation of these SARs as it allows the Pearl River delta to have more freedom in its economic laws and policies, including their nature conservation. In combination with the excellent geographic location this creates the opportunity for the Pearl River delta to be the economic heart of China: The Pearl River Delta constitutes for 40% of the Gross Domestic Product (GDP) of China and 58% of its Foreign Direct Investments (FDI) (Yeh & Xu, 2010). This economic heart has been this way for a longer period of time as the two SARs present in this area were the some of the only colonies China has ever allowed: Macao used to be Portuguese and Hong Kong was part of the United Kingdom. Due to the fact these two regions being the few trading posts available, they have been used very intensively, leading to an almost complete natural depletion in Macao, it only being confined in some gardens and parks (GoAway, 2015), and the loss of all primary forest in Hong Kong (Dudgeon & Corlett, 1994).

Because of the isolation from Chinese mainland, Hong Kong is not restricted to the Chinese mainland laws in their nature conservation and has their own laws and policies on nature conservation, yet is still is part of the Pearl River Delta and has to deal with the changes China makes in the other regions very close to Hong Kong. For example the Chinese government is planning to create a megacity in the Pearl River Delta, almost directly bordering Hong Kong SAR (The Telegraph, 2011) (Figure 2). Building this city may lead to an increase in trade intensity and possible pollution in the Pearl River Delta. The measure of isolation is still very much affected by the fact that Hong Kong is very close to the Chinese mainland, a province of Hong Kong SAR, The New Territories, even is a peninsula of the Chinese mainland.

In natural aspect Hong Kong is special in a way that it is on the border of fresh water/semi brackish water from the Pearl River estuary in the West, brackish water in the Southern transitional marine zone and salt water in the East (Morton, 1987) (Figure 3). Lastly the intensive trade history of Hong Kong and the Pearl River delta has led to the introduction of many alien species in Hong Kong (Yan, Zhenyu, Gregg & Dianmo, 2000). All of this account for a very unique set a circumstances and challenges for nature conservation as aquatic conditions are very special, as high economic projects and urbanization both within and very near to Hong Kong SAR emerge and many non-endemic species are found in Hong Kong. This subchapter will try to address these matters and look into the way Hong Kong SAR organizes its nature conservation and the threats Hong Kong biodiversity faces. The following section will be divided in the current state of conservation in Hong Kong and the threats to nature in Hong Kong.

Analysis of Conservation in Hong Kong:

Current state of Nature Conservation:

In General:

Hong Kong nature conservation is organized surprisingly well considering the fact that Hong Kong SAR often is regarded as a city state: A very intensive urbanization has been going on since the colonization by the British and was only slowed down since the 90's (Trading Economics, 2015). This led to the city increasing in size continuously, yet still 40% of the land area is covered protected by being designated as a Country Park (24) or Special Area (11), a protected area outside of a Country Park (Government of Hong Kong [GovHK], 2015), for an Overview of the terrestrial protected areas see figure 4, with most of these protected areas consisting of highland habitats (Kilburn & Lau, 2012). This is highest percentage of area protected in any administrative region in Pacific Asia (International Union for Conservation of Nature [IUCN], 1998). The biodiversity is considered impressive in Hong Kong as it consists of 1920 species of plants, 55 species of mammals, 23 species of amphibians, 73 species of reptiles, 233 species of butterflies and over 2000 species of moths recorded in 2002 (Yip, Corlett & Dudgeon, 2004), being for example more than the island of Great Britain, despite the land area of Great Britain being about 200 times the size of Hong Kong (Dudgeon & Corlett, 2004). On Lantau island evidence has been found of serious depletion of large mammals (Pei, Lai, Corlett & Suen, 2010), see figure 1 for the location of Lantau Island.

Besides land area Hong Kong SAR also has a large area of marine protected areas in marine parks (4) or marine reserves (1). The marine parks cover 2% of Hong Kong's marine territory. These territories are very vulnerable to pollution and disturbance due to intensive harbor activities in Hong Kong and the Pearl River Delta and due to a strong fishery pressure near the parks (World Wildlife Fund Hong Kong [WWF Hong Kong], 2015).

Legal System in Conservation:

Nature conservation in Hong Kong is regulated in five ordinances (Withford, Cornish, Griffiths & Woodhouse, 2013): Forestry Regulations (Hong Kong Law 2015a), Wild Animals Protection Ordinance (Hong Kong Law, 2015b), Fisheries Protection Ordinance (Hong Kong Law, 2015c), Country Park Ordinance (Hong Kong Law 2015d) and the Marine Park Ordinance (Hong Kong Law, 2015e). Most of these Laws are based on the principle of multiple land-use, as defined by Otte, Simmerin and Wolters (2007): nature can be used in multiple ways and this may lead to an increase in effectiveness of conservation. This is supposed to improve conservation as it gives humans some kind of benefit from nature parks or reserves. This is seen most clearly in the Country Park Ordinance and the Marine parks ordinance: In the Duties of the Authorities it is stated in both ordinances the authority is responsible for facilitating recreational use of the parks:

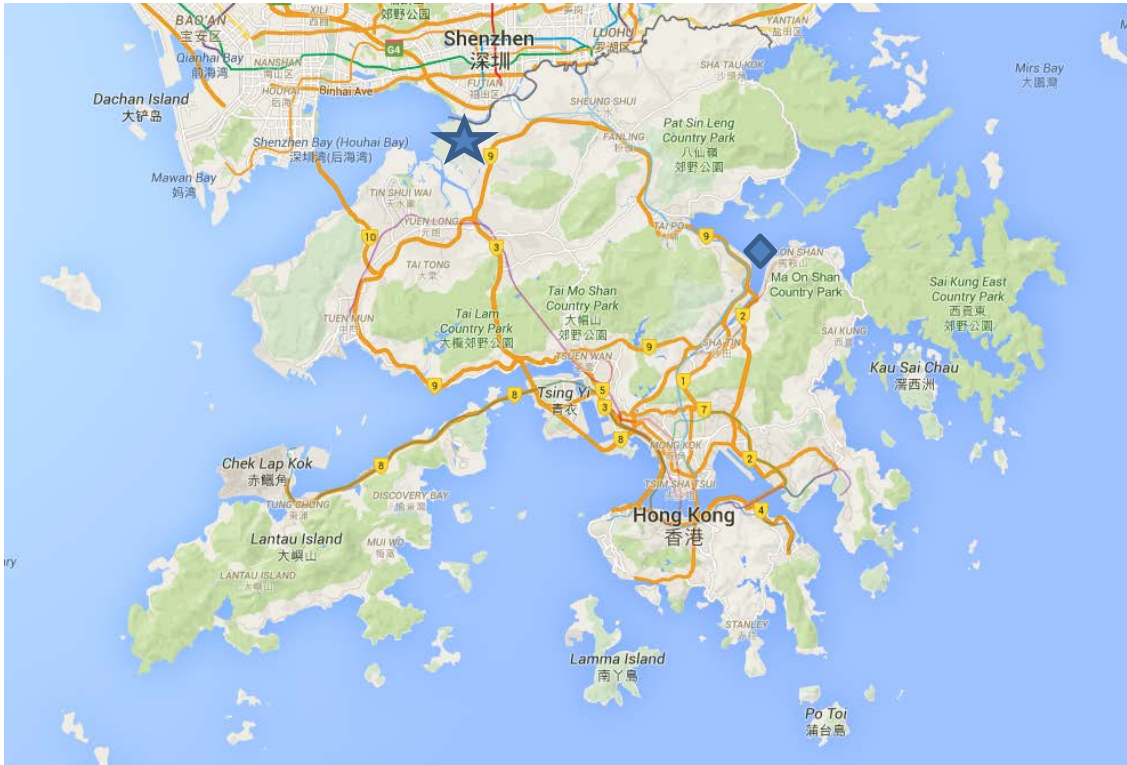


Figure 1: The Hong Kong Archipelago with the New Territories Peninsula province in the North bordering Shenzhen, China and Lantau island depicted as the large island in the South-West. The star indicates the Mai Po Marshes, the Diamond indicates the Tolo Harbor Area (Google Maps, 2015)



Figure 2: Plans of the Chinese Government for the merging of the nine cities, including their current number of inhabitants, in the Pearl River Delta into one megacity, enforcing China's Economic Heart economically by intensifying connectivity through an increase in railways and a merging of communication networks, water networks, energy networks and social services in the whole area, Hong Kong SAR is depicted South of Shenzhen (The Telegraph, 2011).

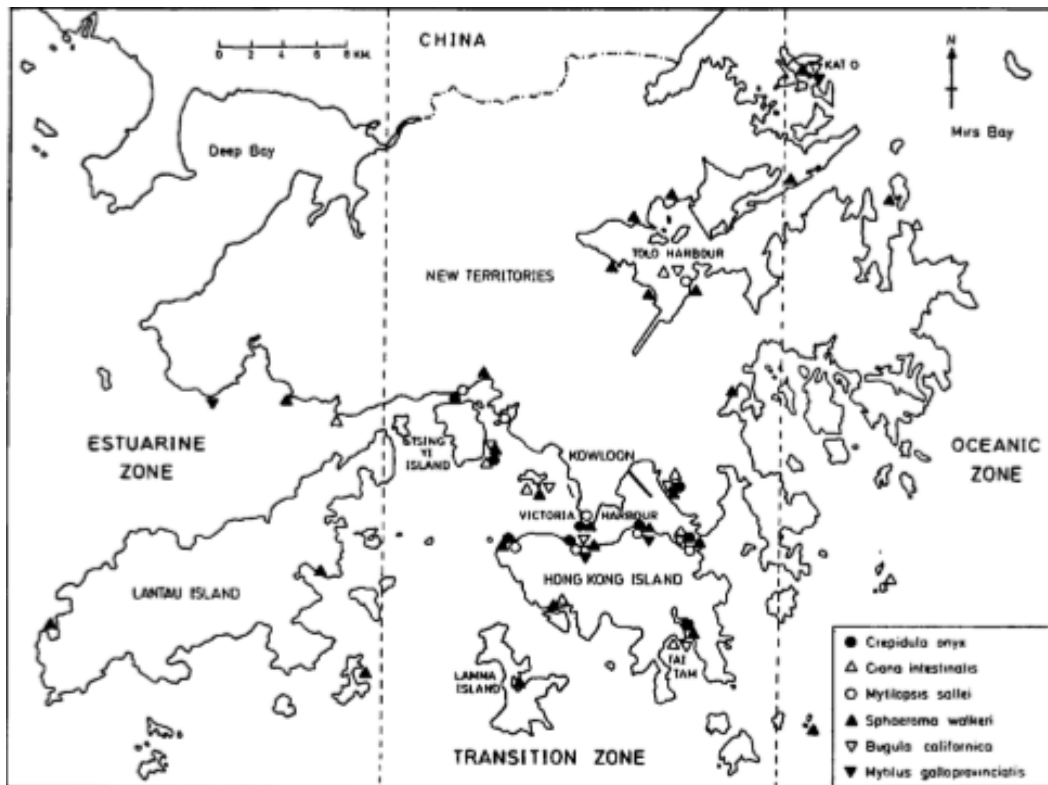


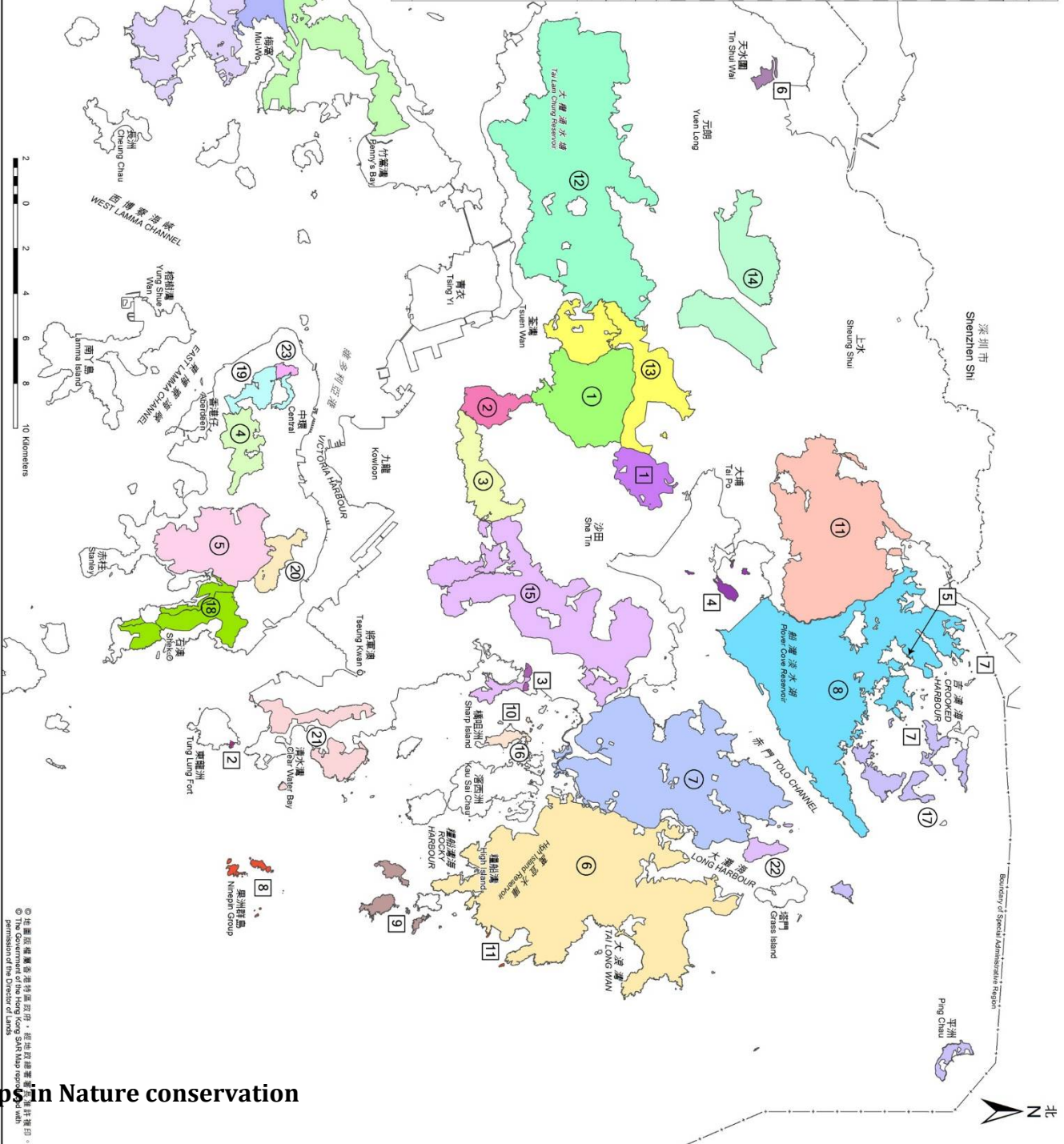
Figure 3: The three different marine zones in Hong Kong SAR with the fresh water/semi brackish estuary in the West, The brackish transition zone in the middle and the salt oceanic zone in the East. The depicted spots are the results of the study of Morton (1987) on the presence of some alien species in Hong Kong.

*“It shall be the duty of the Authority – (section 4)
to take such measures in respect of country parks and special areas as he thinks
necessary to – (section 4c)
to encourage their use and development for the purposes of recreation and
tourism (section 4ci)
to provide facilities and services for the public enjoyment of country parks
and special areas (section 4civ)” (Hong Kong Law, 2015d)*

*“For the purposes of this ordinance, it shall be the duty of the authority - (section 4)
to control and manage marine parks and marine reserves, and to take such
measures in respect of marine parks and marine reserves as the Authority considers
necessary, for the purpose of – (section 4b)
facilitating recreational activities in marine parks (section 4biii)” (Hong
Kong Law, 2015e)*

Clearly these two laws impose a need for conservation to be of any use to humans.

香港現已劃定的郊野公園			
編號 No.	地點 Location	面積(公頃) Area (ha)	指定日期 Date of Designation
1	城門 Shing Mun	1400	24/6/1977
2	金山 Kam Shan	339	修訂/Revised on 30/12/2013
3	獅子山 Lion Rock	557	24/6/1977
4	香港仔 Aberdeen	423	28/10/1977
5	大嶼 Tai Tam	1315	28/10/1977
6	西貢灣 Sai Kung East	4494	修訂/Revised on 30/12/2013
7	西貢西 Sai Kung West	3000	3/2/1978
8	粉嶺 Power Cove	4594	7/4/1978
9	南大嶼 Lantau South	5640	20/4/1979
10	北大嶼 Lantau North	2200	18/8/1978
11	八仙灣 Pat Sin Leng	3125	18/8/1978
12	大帽山 Tai Mo Shan	5412	修訂/Revised on 30/12/2013
13	林村 Lam Tsuen	1520	23/2/1979
14	馬鞍山 Ma On Shan	2880	修訂/Revised on 18/12/1998
15	船灣 Kuo Tsui	100	1/6/1979
16	粉嶺(擴建部分) Power Cove (Extension)	630	1/6/1979
17	石壁 Shek O	701	修訂/Revised on 22/10/1993
18	薄扶林 Pok Fu Lam	270	21/9/1979
19	大潭(魚魚涌擴建部分) Tai Tam (Quarry Bay Extension)	270	21/9/1979
20	清水灣(鰲魚灣擴建部分) Tai Tam (Quarry Bay Extension)	615	28/9/1979
21	西貢西(魂仔擴建部分) Sai Kung West (Wan Tsai Ext.)	123	14/6/1996
22	龍防山 Lung Fu Shan	47	18/12/1998
23	北大嶼(擴建部分) Lantau North (Extension)	2360	7/1/2008
總面積 Total Area		43,455	
香港現已劃定的特別地區(位於郊野公園外)			
Designated Special Area in Hong Kong (Outside Country Park)			
編號 No.	地點 Location	面積(公頃) Area (ha)	指定日期 Date of Designation
1	大埔郊自然護理區 Tai Po Kau Nature Reserve	480	13/5/1977
2	雙龍洲砲台 Tung Lung Fort	3	22/6/1979
3	蕉坑 Tai Heng	24	18/12/1987
4	馬屎洲 Ma Shi Chau	61	9/4/1999
5	荔枝窩 Lai Chi Wo	1	15/3/2005
6	香港濕地公園 Hong Kong Wetland Park	61	1/10/2005
7	印洲灘 Double Haven	0.8	1/1/2011
8	果洲群島 Ninetip Group	53.1	1/1/2011
9	樓船洲 Sheep Island	176.8	1/1/2011
10	樓船洲 Sheep Island	0.06	1/1/2011
11	樓船洲 High Island	3.9	1/1/2011
總面積 Total Area		845	



PLAN No. KCP/Plan_1-C283A



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Dec 2013

Gaps in Nature conservation

Figure 4: Map of Country Parks and Special Areas in Hong Kong SAR, Hong Kong City is situated just North of Country Park 4 (Aberdeen Country Park)) (Agriculture Fisheries and Conservation Department [AFCD], 2013)

International wildlife trade

China is also one of the greatest in endangered species trade. In China it is still regarded as a status symbol for wealthy Chinese to eat endangered species, the more rare a species, the better the status of the individual (The Guardian, 2014; Nowell & Xu, 2007). Hong Kong might be autonomous to a certain degree from China, yet it still is one of the biggest trade harbors in China and so many of the endangered species trade is channeled through Hong Kong (Lau, 2014; Clarke, Magnussen, Abercrombie, McAllister & Shivji, 2006). The trade in shark fins for example is as much as 50% of the global trade in Hong Kong (Fong & Anderson, 2002) and endangered tigers are something still consumed or used in medicine in the Pearl River Delta (Gratwicke et al., 2008). The Wild Animals Protection Ordinance (Hong Kong Law, 2015b) always speaks about endangered species from Hong Kong, if an endangered species is not from Hong Kong or the individual is an endangered species in Hong Kong, but was caught outside of Hong Kong territory the Wild Animals Protection Ordinance (Hong Kong Law, 2015b) does not seem to apply. This may lead to a very significant threat to international wildlife.

Threats to Hong Kong SAR's Nature

There are several threats that need to be addressed to understand better what nature conservation in Hong Kong is facing. Threats to Hong Kong's Natural environment include habitat destruction due to urban development and illegal damage of sites (Hopkinson, 2012; Jefferson, Hung & Würsig, 2009; AFCD, 2008; WWF Hong Kong, 2016), highly intensive fishing (Parsons & Jeffersons, 2000; Hopkinson 2012; WWF Hong Kong; 2016), pollution (Hopkinson 2012; Environmental Protection Department of the government of Hong Kong Special Administrative Region [EPDHK], 2015a; EPDHK, 2015b; Jefferson et al., 2009; Zheng, Lam, Lam, Richardson, Man & Li, 2000; Xu, Lam, Zhao, Zhan, Chen & Tao, 2003), climate change (Hopkinson, 2012) and invasive species (Hopkinson, 2012; Kilburn & Ming, 2011; Yan et al., 2000; Global Invasive Species Database [GISD], 2015). Some literature states the Hong Kong conservation is only preserving nature instead of trying to find new ways and new areas to improve biodiversity and natural conditions (Kilburn & Lau, 2012; Lau, 2011).

Habitat destruction, Urban Development and Fishery Activities

The Habitats in Hong Kong seems to be under a significant stress from urban development, sometimes even leading to the illegal damaging of many habitats. In the years between 2000 and 2008 Hong Kong lost 65 percent of their wetland habitats due to habitat destruction. All this destruction was significantly correlated with urban development (AFCD, 2008). Hong Kong has also lost about 900 hectares of marine habitat due to habitat destruction between 1997 and 2011 (HKSAR government, 2012). Once again correlated with the urban development in these areas.

Many cetaceans are found damaged by fishing and harbor activities due to the Hong Kong harbor and the Pearl River Delta intensifying their harbor activities. Parsons & Jeffersons (2000) data suggest that although the cases of damage by ships and fishing nets are uncommon, they most certainly do occur. The WWF Hong Kong (2016) expect an increase in marine traffic and development in the area north of Lantau Island, leading to a serious threat to several organisms, in particular the Chinese White Dolphin; They even expect the developments to engulf some hotspots of the Chinese White Dolphin (figure 5).

Other studies have shown a very clear fragmentation of the habitats of organisms. Many of the larger mammals seem to be struggling with connectivity issues. Some mammals like the Crab-Eating Mongoose (*Herpestes urva*) have great difficulty to reach beyond the

main peninsula in the North. Research has shown Lantau Island is completely depleted of some larger mammals, even though the area is suitable for many mammals to live in (Pei et al., 2010).

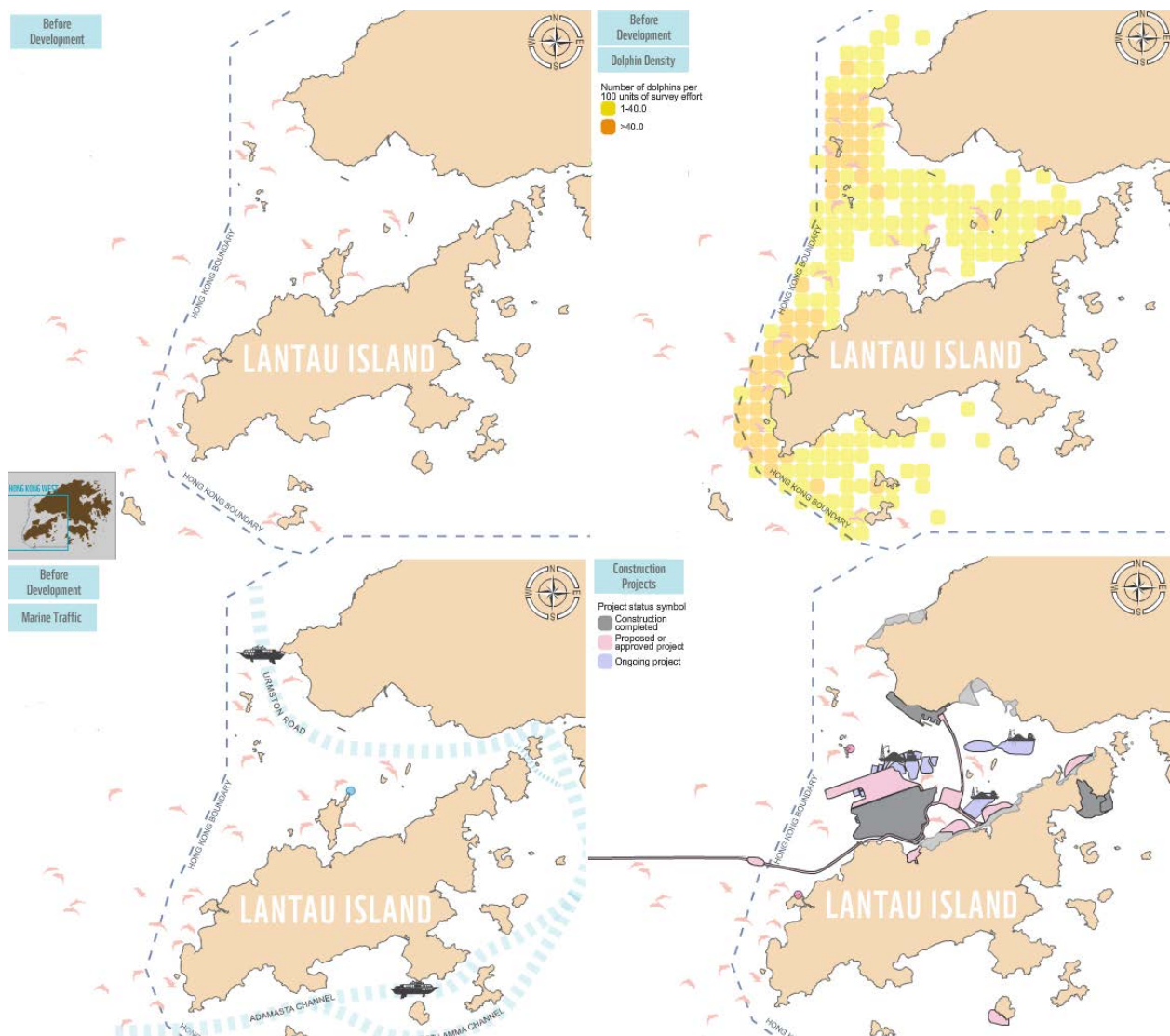


Figure 5: The Lantau Island Area (top Left): Occurrence of the Chinese White Dolphin (top right), the current marine traffic routes (bottom left) and the (planned) Developments in the Lantau Island Area (bottom right). Clearly the occurrences of the Chinese White Dolphin, the marine traffic and the (planned) developments are in the same areas near Lantau Island, posing a serious threat to the animals (adapted from WWF Hong Kong, 2016)

Pollution

Big parts of Hong Kong have been subject to pollution by anthropogenic chemicals in the past. Research has shown the areas Mai Po Marshes (Zheng et al., 2000) and the Tolo Harbour (Xu et al., 2003) to be some of the worst polluted sites in Hong Kong.

Mai Po (see figure 1 for the location) is regarded as an area crucial in many ecological aspects: it is known for being a resting place for many migrant birds on the Australian-Asian route. Without it many difficulties would arise if these marshes were to diminish or even disappear at all. Yet research has shown this particular marsh is also found to be a sink for many organic pollutions: Elevated levels of many Chlorohydrocarbon chemicals, like the notorious DDT, have been detected as a result of the many years of

pesticide use in the trade area of the Pearl River Delta, needed in the past to maintain a healthy crop yield to feed the trade in the Pearl River Delta and Hong Kong. These persistent pollutants could very much lead to disastrous concentrations in the higher trophic levels if left unchecked, leading to a disturbance in the vagrant bird ecology. In Tolo Harbour (see figure 1 for the location) a more detailed study on all the responses of organisms to the water quality. This study found highly elevated levels of the Biochemical Oxygen Demand (BOD), a measure for the oxygen needed by organisms to maintain their metabolism, as a result of the many anthropogenic pollutants in this area due to the harbor activities and the industry and agriculture to maintain this. It even showed many shifts in community assembly in this area. Many different species compositions were found in the areas of Tolo Harbour compared to other sites (Zheng et al. 2000).

Invasive species

Invasive species are a significant threat to the nature in Hong Kong and are commonly found in many major groups of organisms: the review from Yan et al. (2000) reported invasive birds (e.g. the sulphur crested cockatoo (*Cacatua sulphurea*)), fish (e.g. the Mosquitofish (*Gambusia affinis*)), molluscs (e.g. the Giant African Snail (*Achatina fulica*)), nematodes (e.g. the North-American Pinewood Nematode (*Bursaphelenchus xylophilus*)) and plants (e.g. the South American Climber (*Mikana micrantha*)). The Global Invasive Species Database [GISD] (2015) reports 45 invasive species in Hong Kong in even more different groups of organisms than Yan et al. (2000), adding confirmation of the presence of invasive species from reptiles (e.g. the-red eared slider (*Trachemys scripta elegans*)), Insects (e.g. the Erythrina Gall Wasp (*Quadrastichus erythrinae*)), Mammals (e.g. the Crab-eating Macaque (*Macaca fascicularis*), Amphibians (e.g. the American Bullfrog (*Rana catesbeiana* or *Lithobates catesbeianus*)) and Tunicates (e.g. the Sea Vase (*Ciona intestinalis*)).

Some invasive species in Hong Kong are the result of populations that were introduced for economic or sometimes even ecological reasons, yet grew to become pests or to show ecological interaction not previously anticipated in greater parts of Hong Kong and Chinese mainland. The trade history of Hong Kong was especially supplemental for the introduction of many alien species for gains. Other species were introduced unintentionally as stowaways of trade convoys and travelers. This indicates the importance of the trade history of Hong Kong in the presence of invasive species (Yan et al., 2000).

Invasive species are harmful to the nature of Hong Kong in many ways. Among the threats caused by invasive species in Hong Kong are for example overgrown populations dominating food sources (*Solenopsis invicta*), Preventing germination of local flora (*Tradescantia spathacea*) or destroying local fauna through the consumption of their eggs and breeding grounds (*Acridotheres tristis*) (GISD, 2015).

Conclusions

In general Hong Kong is regarded as an example for the whole of Asia. The Nature conservation in Hong Kong has led to a relatively high species diversity and it seems to be fairly protected. The success of Hong Kong in nature conservation compared to the rest of Asia seems to be rooted in the concept of multifunctional land use: Making conservation areas usable by humans for recreation of any other kind of activity has

made conservation a possible policy strategy. Although many Biologists think the multifunctional land use is not the attitude we should be advertising in conservation, it does seem to help Hong Kong and in this way create an oasis of biodiversity in continent struggling with many conservation issues.

Furthermore the political isolation of Hong Kong has facilitated many possibilities for a new framework in conservation. Isolation has given Hong Kong more possibilities in legislation and policy for conservation.

Hong Kong has persisted even though many challenges are on the path of this small semi-autonomous state. Political Isolation and Multifunctional land use has not been able to avert any threats, yet it has shown to be an effective strategy in conservation. Tests with the application of local legislation and policy and multifunctional, mainly recreational, land use may be very appropriate to conduct on the rest of Asia to cope with the increasingly worsening state of conservation in South-East Asia. Perhaps starting with Hong Kong's twin City Singapore, may lead to promising results in nature conservation further South: Many possibilities await for Asia and many challenges await for all.

Water Management in Singapore and Batam (Indonesia)

Singapore's innovative water management reviewed as possible solution for upcoming conflicts in Batam



Abstract

Although only 21 km of sea separates the islands Singapore and Batam (Indonesia) from each other, large differences in facilities is separating the Islands too.

In the last 50 years Singapore imported almost every cubic meter water from the Malaysian peninsula, but independency is triggering Singapore to become self sufficient in it's resources. Privatization of the water supply and Highly developed techniques are allowing Singapore to become self sufficient in water. The current trends of the nation let us expect that Singapore will be self sufficient in water in less than 50 years.

Unfortunately Singapore's economy is growing thanks to cheap labor retained on the Indonesian island Batam. Pollution of drinking water and sedimentation of the natural reservoirs is occurring on large scale. Applied techniques such as UV disinfection can increase the water quality of Batam, but also stricter policies from the government are required to reduce the poor conditions on the island.

Introduction

In the first two decades after the second world war, countries in the southern part of the South Chinese sea became independent, after more than 300 years being colonized by the Dutch, British and Portuguese. One of the last modern countries that became independent in this region is Singapore. The economic centre of this region became a city-state. This change in land boundaries made Singapore to one of the most developed countries in the region and increased employment for its residents. Economically the country was developing, but in land surface the country declined significant. With a small land surface and a densely populated country it is guaranteed that resource problems will occur without good development in policy and technology. Two years before independence in (1963), Singapore experienced its worst and also longest water shortage period. During 10 months the entire water supply of Singapore was suspended every day between 8:00 am and 8:00 pm (Liu & Williams, 2014). The severe water level of 1963 made the Singaporean government in 1965 realize that a larger catchment or bigger water supply was required if the country wanted to be independent (Liu & Williams, 2014).

In 1961 and 1962 Singapore already signed agreements with the Malaysian district Johor for a water supply until respectively 2011 and 2061. (Liu & Williams, 2014, PUB, 2014) Because this water supply is eventually not sustainable for Singapore, the state government decided to become self-sufficient in water before the agreements ended.



figure geographical location of Singapore and Batam

Only 20km away from Singapore, the Indonesian island Batam is situated. The residents of this nearly located islands, with according to the guardian one of the largest population growth rates of the world, are suffering by the lack of several human rights. Sari (2002) claims that mainly the Indonesian government, but also international companies are responsible for the bad conditions on the island. Companies retain cheap labour from Batams residents and usually end up in Batam after being situated in Singapore first.

Economic growth took priority over social and environmental factors in Batam (Royle, 1997). Consequently Sumatra's economy was left far behind and a migration wave of squatters came to Batam for work (Sari, 2002). Due to the migration wave and the establishment of international companies it sounds plausible that Batam will eventually face similar water management problems as Singapore. Therefore it is important to

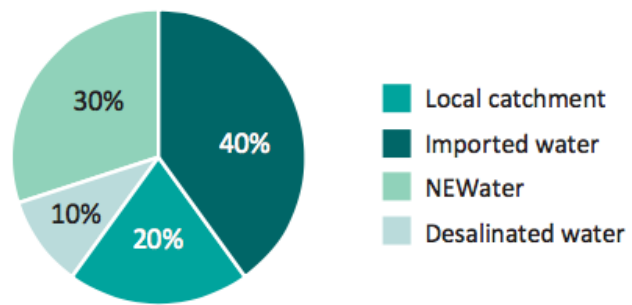
know how Singapore is able to provide its residents with drinking water in 2061 and to what problems, research or special attention is required in Batam.

Batam and Singapore do have a special trade relation, since 1978 both economies are no longer competitive. The islands have also a similar climate and Singapore is partly responsible for the establishment of companies on Batam. Therefore Batam sounds as a perfect candidate for Singapore to export its water management solutions to.

In this research the differences in facilities between both islands, the reasons for these differences and possible/required actions are outlined.

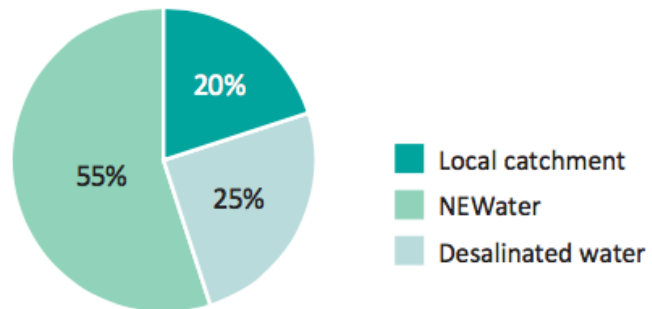
The current water management of Singapore

An already good comparison between two equal situations is made by Liu & Williams in 2014. Their research illustrates the differences in drinking water supply in Singapore and Hong Kong. Both countries have currently over 5 million residents (Hong Kong 7.1 million, Singapore 5.3 million) and further more a high population density which are both expected to be increased by a



figure

million in only 15 years (Liu & Williams, 2014). This increase is the reason that water supplies in both countries need to be increased, and at the moment water is becoming scarce in both countries. The Dongjiang river which provides fresh water for Hong Kong is declining in its output due to the increasing population growth of China. With



figure

this information Liu & Williams suggest that the fresh water problem is probably more urgent for Hong Kong. However Singapore faces some challenges as well. Although the countries water supply from Johor is not expected to dry-up, it will expire in less than 50 years. Together with the widely spread conception of not being a sovereign state, because of the purchased water in Malaysia (Xi & Poh, 2013), Singapore's government felt responsible to start a self-sufficiency program on fresh water. The developments of this program are according to Liu & Williams (2014) very promising. Figure 2 and 3 are illustrating respectively the current (2012) and future (2061) water supply of Singapore. The goal is to suspend eventually the imported water from Malaysia (Liu & Williams, 2014).

To become self sufficient Singapore took already several steps. On the first of May 1963 the Public Utilities Board (PUB) was established to coordinate the supply of electricity, piped gas and water in Singapore. In 2001 the PUB became Singapore's national water authority to close Singapore's water cycle. The PUB became privatized and the coordination of electricity and gas was adopted by the Energy Market Authority (EMA) (PUB, 2014). Water is now an economic good in Singapore, it is not only priced to recover the costs of production and developing additional water sources, but to reflect the scarcity as well (Tortajada & Joshi, 2013).

Thanks to strategic planning, investment, research and technology, PUB is providing the water supply with four national taps: Local catchment, NEWater, Desalinated water and Imported water (PUB, 2014), of which imported water eventually will be suspended.

Local Catchment

Two separate systems are currently collecting rainwater and used water. A comprehensive dammed network of drains, canals, rivers and storm water ponds is collecting the water and finally channels it to 17 artificial storages in Singapore (PUB, 2014). The highly dense populated city with a large amount of urban areas is the reason why natural reservoirs such as forests disappeared on the island. According to Boks & Rioza (2015) and Vlotman W. F. (2007) water catchments do have a lack on water holding capacity after urbanization. In 2011 the 16th and 17th artificial reservoirs were opened, resulting in a local catchment that covers 66% of Singapore's land surface (PUB, 2014).

NEWater

30% of the current water supply in Singapore comes from the source 'NEWater', this water is made from treated used water, purified by membrane technologies and ultra violet disinfection methods.

Ultra violet disinfection is according to Sommer et al. (2008) successful if the next 3 steps are applied: 1. Knowledge of the UV resistance of health related microorganisms transmittable by water, 2. An objective evaluation of commercial UV plants, 3. The surveillance during practical application. The three statements are further substantiated in the tekst box below.

For a successful UV disinfection a 3-step approach has been proven to be useful:

1. Knowledge of the UV resistance of health related microorganisms transmittable by water: These investigations can only be performed under strictly controlled laboratory batch conditions ("collimated beam"). The requirements for a UV laboratory device are given in each of the 3 standards mentioned here. UV-inactivation data obtained from flow-through irradiation systems are not reliable in this respect since the conditions are not well controlled (occurrence of fluence distributions). Checking solely the presence of Escherichia coli and enterococci in 100 ml water volume – as it is done in routine bacteriological water monitoring – has to be regarded as insufficient for the surveillance of disinfected waters. This is because these indicator bacteria are much more sensitive to disinfection measures (UV, chlorine, ozone) compared to most of the water related pathogens (e.g., viruses). Therefore the surveillance of the disinfection process has to be carried out by checking the defined technical parameters (flow, reference irradiance, water transmittance) obtained during the validation test of the UV plant.

2. An objective evaluation of commercial UV plants: due to the lack of a method for the direct measurement of the microbicidal UV fluence in commercial water disinfection plants, it is necessary to establish a standardized procedure for the testing and evaluation of such plants to guarantee that only well functioning UV plants are on the market. Numerous microbiological investigations have been undertaken to evaluate the performance of commercial UV disinfection plants. Since most of these tests were not performed under standardized conditions, different assessments were obtained, sometimes even for one and the same UV plant. Thus an objective evaluation of the microbicidal efficacy of UV systems is the prerequisite for their reliable application in water disinfection.

3. The surveillance during practical application: from the data of the type test, admissible operating ranges and alarm points are determined. Due to regular controls during the practical operation of the UV plant in the water works, it is assured that these parameters are complied with. To measure the reference irradiance, commercial UV plants have to be equipped with a calibrated UV sensor fixed at a standardized measuring window at a reference position in the irradiation chamber (sensor reading in W/m²). The sensor has to be removable during operation of the UV plant to enable a check against official specifications providing an independent, objective inspection, often demanded by health authorities.

Sommer et al. (2008)

The NEWater project started in 2003 with a demand for 15 mega gallons per day (mgd), but today the demand for this NEWater is already 60 mgd which is equal to 273.000m³ per day. This ultra clean water is distributed via a separate network to industrial and commercial customers (PUB, 2014). Remarkable is that only a small percentage is available for consumers as tap water. This part is mixed with water in the artificial reservoirs and subsequently treated in the waterworks before it is available as tap water (PUB, 2014).

Desalinated Water

Singapore has 2 desalination plants, together with a production of 100 mgd. According to the most recent numbers both plants together meet up to 25% of Singapore's water demand (Pub, 2014). The plants use reverse osmosis to desalinate seawater. Reverse osmosis membrane is the leading technology for new desalination plants (Greenlee et al., 2009). PUB states that in its desalination plants seawater goes through a pre-treatment process where suspended particles are removed, before it is treated with reverse osmosis. After desalinated water is blended with treated fresh water it is distributed to homes and industries in the Western part of Singapore.

The future perspective for Singapore

If Singapore pursues the current development in water self-sufficiency, the technical situation of water supply becomes sustainable. Regarding the running program for self-sufficiency, for each of the 3 relevant taps there is a plan for developing. PUB plans to boost up the local catchment to 90% of Singapore's land surface by 2060. All the major estuaries are already dammed, now the remaining tributaries have to be dammed in as well. However one of the major constraints is the brackish water in this tributary estuaries. Greenlee et al. (2009) argues about different desalination techniques that are required for desalination of brackish water. Although it is not more complicated, other plants for this type of desalination are required. The final goal is to obtain 20% of the total water demand from the local catchment.

The NEWater capacity is planned to be tripled. In 2060 55% of the water demand should be provided by the NEWater technology. To achieve this goal, it is necessary for Singapore to open more NEWater plants. Since this technique is practical only recycling water the water cycle needs to be increased in other ways. One of those ways is via the increase of the local catchment. The other way should be via the desalination of water. The plan is to retain still 25% of the water demand from desalination of sea water in 2060. For this goal extra desalination plants are also required.

The only thing that PUB is not mentioning is a plan to increase water storage reservoirs. Although Liu & Williams (2014) published a list with new artificial reservoirs in Singapore, which suggest a trend, this point requires extra research.

The current situation on Batam

21 km to the south of Singapore, the 415 km² island Batam is situated (Royle, 1997). In 1971 the Batam Industrial Development Authority (BIDA) was started (BIDA, 2002). In that period Batam was a typical oil distribution point, since 50% of the Indonesian oil was coming from the Riau archipelago. The distribution point in Batam was designated to compete with Singapore, because Singapore earned most of the oil value by producing refined fuels after imported crude oil from the Riau (Sari 2002).

In 1978 the entire island became a duty free zone what made the economic relationship between Singapore and Batam not longer competitive, and in 1990 the Singapore Johor Riau (Sijori) growth triangle was ensued from the Riau agreement, signed in the same year. It was formed to decrease the constraints of national boundaries between Singapore, Johor (Malaysia) and the Riau archipelago (Indonesia) (Sari, 2002). But Sari (2002) explains also that in reality the Sijori growth triangle results in agreements between companies from Singapore and European or North American countries, which settle thereafter in Batam, where cheap land values and labor is more apparent than in Singapore or Johor. This results in a high profit agreement for companies in Singapore while all the labor and pollution is occurring in Batam.

Strange legislation in Batam is probably one of the reasons why Sari (2002) is complaining about environmental and human rights violations in Batam and its residents.

Special laws are focused on the manufacturing industry, e.g. foreign investors in Batam do not require a Indonesian partner for the first 5 years (Royle, 1997). After being settled for 5 years at least 5% of the holdings have to be assigned to Indonesian companies. As result of this law, 24% of Singaporean investments in 1997 within Asia were in Indonesia and 58% of these investments were in the manufacturing sector.

Although economic progress has been impressive, due to the special trade zone in

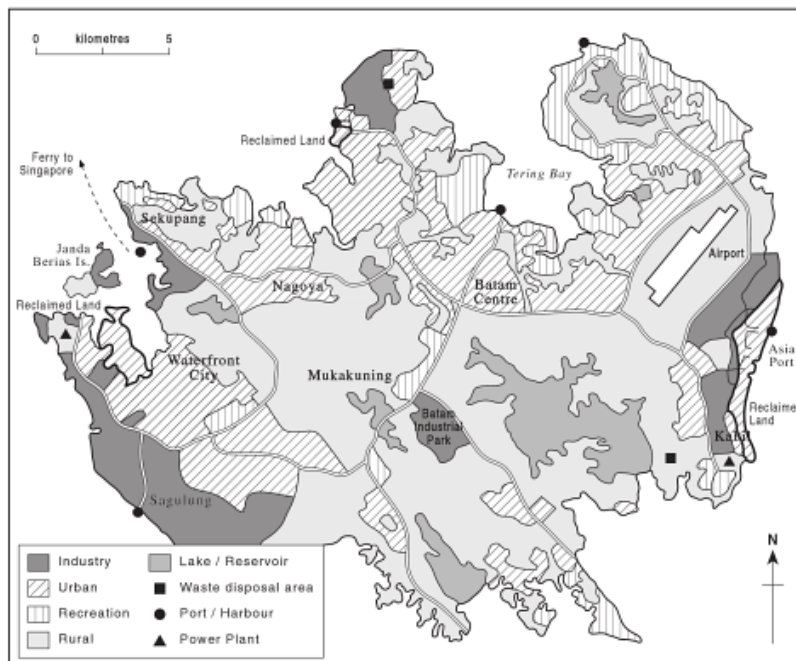


figure source: Peachey (1998)

Batam. Sari (2002) is cautioning about more apparent environmental and human rights conflicts on the island. The research of Sari points out some emerging factors that can be related directly to availability of safe drinking water, and the economic growth as a result of the Riau agreement. The largest manufacturing industry in Batam is the electronic industry; the use of toxic substances is polluting natural fresh

water reservoirs. Albir & Hernandez (2011) are also warning about every electronica

industry and its environmental pollution, because its waste can not be treated conventionally. On the map obtained from Peachey (1998) in figure 4 is also noticeable that industrial areas are located close to urban areas. It is obvious that chemical pollution in this area ends up easily in the open sewerage. Furthermore Batam



figure , Batams fresh water reservoirs according to BIFZA (2008)

Industrial Park is located between two major lakes or reservoirs of the island, which suggest a large amount of chemical pollution in the fresh water supply.

Environmental pollution from manufacturing is not the only alarming situation on the island concerning water availability and quality. Erosion of land, causes sedimentation in the reservoirs (Sari, 2002). This factor can also be substantiated with the map from Peachey (1998). Changes in agricultural practices are potential causes for an increase in

sedimentation according to the research of Lexartza-Artza & Wainwright (2011). They substantiate a coincidence between agricultural changes and sedimentation in fresh water reservoirs. Since the natural reservoirs are located in the middle of rural Batam it sounds plausible that economic change causes extra sedimentation in these reservoirs. Finally Sari (2002) and Royle (1997) both mention the increase of residents and squatters on the island due to the economical expansion. In the introduction of Royle he describes Batam as an island with a surface approximately 2/3 of Singapore and 155.000 residents. At the moment the government linked institute BIFZA estimates the amount of residents in Batam over one million. With such different numbers for sure there are different measuring techniques and indications applied, however a significant population growth seems plausible as well. This factor is practical equal to the problem Singapore faced in the last century.

Squatters are currently settling in protected forests whose function is contribution to the rainwater catchment (Sari, 2002; Royle, 1997), this results consequently in a decrease of the catchment and the ground water table. Moreover the introduction of new artificial pathways is also a source of increased sedimentation (Lexartza-Artza & Wainwright, 2011). This can be a real threat for Batam Since economic refugees from Sumatra squatting in the forests of Batam, in general will not consider the potential hazards of a new established community with artificial pathways for residents and water.

The future perspective for Batam

Although the population in Batam is only 20% of the population in Singapore the current trends of prioritizing the increasing economy over environmental and humane issues will eventually lead to more social problems and is certainly not sustainable. But there are large geographical differences between both islands. Singapore is an independent state and requires therefore self-sufficiency in water supplements. Batam, however is economically a free trade zone and has a large amount of privileges over other parts of Indonesia, but it still belongs to Indonesia and contributes to the countries economy. In the lecture of Godfrey Baldacchino (11-11-2015) and in the research of Royle (2010) it became clear that independence is neither always recommended nor desirable. The example of the Falkland Islands (Royle, 2010) shows that small islands with a small amount of resources keeps an island dependent on the bigger countries. Islands like Bermuda, which are bigger and maybe able to be self-sufficient, still stay overseas territories from the United Kingdom by pragmatic reasons (Royle, 2010). Although Batam is not trying to become independent from Indonesia, the descriptions from Royle (2010) explain also why it is not necessary for Batam to apply the complex technologies from Singapore. Batam simply can import water from bigger catchments on the main islands of Indonesia without paying a bill.

While studying the situation of Batam and Singapore it becomes clear that water management in Batam is not an urgent problem for the island. Water quality however is very poor in the whole of Indonesia and also on Batam. Improvement in water quality by stricter legislation for manufacturers on Batam is advisable and should be investigated. Indonesia as a G20 country, should be able to develop better facilities on the island Batam, but struggles naturally with a whole country that is almost the same size as the United States of America.

Since Singapore developed very impressive methods and water recycling plants and retains a large amount of cheap labor on Batam due to its own restrictions of being an independent island, Singapore should also take responsibilities for facilities on Batam.

Conclusion

While Singapore seems to have a carefully planned schedule to increase the water availability. Batam is polluting the water reservoirs and declining them (unconsciously). The techniques applied in Singapore cost a large amount of money undoubtedly. But Singapore's alternative is importing water like Hong Kong is doing. At the moment Singapore is already importing water from Malaysia but in 2061 the second agreement with Malaysia will expire. This together with the claim to be self-sufficient to be a sovereign state from neighboring countries forces Singapore to develop the water self-sufficiency program. The running program is a role model within renewable water supply techniques. The Public Utilities Board owns Singapore's water reservoirs and supplies the water to all its consumers. PUB's plan to make Singapore self-sufficient in 2060 made a good promising start and is clearly explained on the website of PUB. Moreover these techniques can be applied on other islands with a small local catchment – residents' ratio.

In "Clearing confusion in a disembedded World: The case for Nissology", McCall (1996), Grant McCall explains that the difference between islands is determined by their control. Singapore is a classic example of Islander control while the Indonesian control of Batam is in my interpretation similar to Continental Control.

McCall states in his research that the difference in control leads to innovation and

Islander Control	Continental Control
Innovation	Conservatism
Monument-oriented	Exchange-oriented

figure , McCall (1996)

its residents become conservative and mimic their masters; furthermore they become exchange oriented with island resources. Which is the case in Batam, where the resources of oil were traded for money and food and currently the benefits of a free trade zone are traded for money

To Batam where the amount of residents is increasing, the environmental pollution is increasing, and the local catchment is declining, it could be a solution to establish a privatized company that renews used water and keeps squatters away from the protected areas, just like in Singapore. But since Batam is not trying to become a sovereign independent state there are no constraints for Batam to import its water from the Indonesian main islands when water becomes scarce exactly as the model of McCall says.

However the current situation on Batam seems very bad for the water quality on the island and that requires more attention. Not because it makes Batam less dependent from Indonesia, but because it will contribute to the populations health and decrease the violation of human rights in Batam.

Pollution from electronica manufacturing should be controlled and policy makers should be clearer in legislation. In Singapore techniques with ultra violet disinfection and membrane technologies are already applied. Application of those techniques to the drinking water in Batam will be a huge improvement for the island and is highly recommended.

Today the culture in Batam and almost every part of Indonesia is still to serve a warm glass of water to your guests as a sign that it is cooked and clean to drink.

elaboration of cultural monuments and other works. The elaboration of Singapore's water management belongs to these other works.

When an island is in continental control, McCall (1996) states that

General Conclusion

In this book chapter different situations on different islands are described all from the Malay Archipelago. The first part of this book chapter concluded that the Malay Archipelago has a long history of foreign influences and that being a has an influence on the development of Bali and its religion. The second part of this chapter about the nature conservation in Hongkong concluded that there are a lot of gaps and pressure in nature conservation due to the trade systems, however there is more progress. In Singapore and Batam the current water management trends are not sustainable. There need to be water import from bigger island and Indonesia is responsible for a better water quality.

These conclusions all seem totally different and not comparable. Although there is a shaping factor in the region that connects all the islands. This shaping factor in the Malay Archipelago is trade. First, the patterns in the religion were shaped by the Dutch colonists mainly driven by trading systems. Furthermore, the water management in Singapore has taken giant leaps to avoid future economic problems. Trade in Batam is constraining water quality and water availability. Moreover, nature conservation in Hong Kong is under great pressure due to trade in the Pearl River Delta. At last the economy causes an over usage of the natural resources in Borneo. There can be concluded that trade has a lot of influence is the Malay Archipelago region and can be considered as a shaping factor.

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Learning from islands

A case study of the Philippines and the Maldives



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Abstract

This book chapter consists of three case studies and focusses on different ways of how islands can act as models for other systems on our planet. In the first case study, the focus will be on 'what makes an island an island'. This knowledge is applied to the gated communities in Metro Manila. The second case study discusses the influence of tourism on environmental and economic aspects on the Philippine island Boracay and how to manage this in a sustainable way. The last case study takes it to a broader perspective and examines the consequences that climate change has on the socio-economic system of the Maldives. From these three case studies it can be concluded that different types of systems on islands can act as models for larger-scale systems in our world. In order to understand these systems completely and to be able to use them as models, it is important to approach these systems in an interdisciplinary way.

Introduction

“Islands act as models for our planet” (Norder & Rijdsdijk, 2015). This is common knowledge for nissologists. But how does this work in practice? This book chapter examines this question through three different case studies, two about the Philippines and one about the Maldives.

The first paper is a case study of an island of the Philippines namely Luzon, and then in particular the capital Manila. This paper examines whether the gated community (subdivision) of the city can be qualified as an island, since it is segregated from the rest of the population. The wealthy people in the gated community have isolated themselves from the poor people outside the walls. Regarding this study case an island is not always a landmass surrounding by water. There are many other isolated areas with their boundaries that can be qualified as an island helping us to understand large scale complex systems.

The second paper will examine the consequences of coastal tourism on Boracay and how this can be managed in a sustainable way, in which both social-economic and environmental aspects are evaluated. In the past decades the island was becoming dependent on coastal tourism. This resulted in a rising demand for development, so that is why the pressure generated from human activities have an inevitably impact on coastal ecosystems, especially on islands. Huge environmental and socio-economic changes are taking place, since Boracay’s insularity has disappeared. As coastal tourism is almost totally dependent on the natural attractiveness of the island itself, it is important to manage development in a sustainable way.

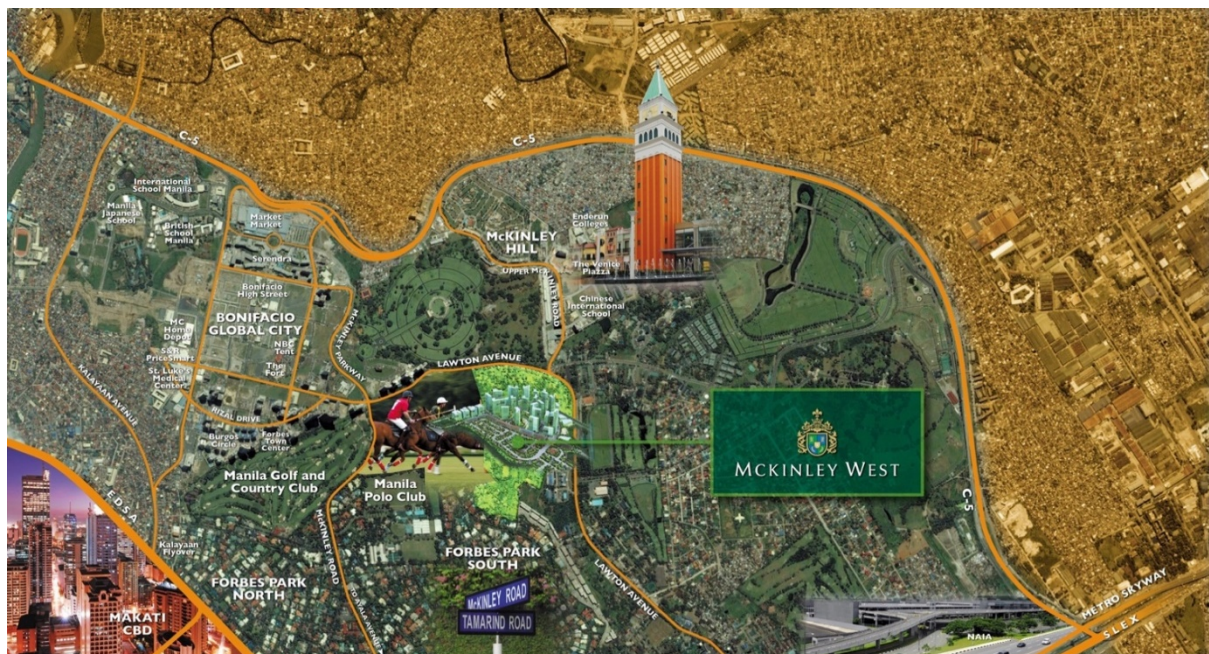
The third paper is a case study of the Maldives. The Maldives is the flattest country in the world and therefore extremely vulnerable for the impact of climate change. In the case study, this vulnerability is examined, specifically through the research about the consequences that climate change has on the national socio-economic system of the Maldives. Since the Maldives consists of islands, the boundaries to this socio-economic system are far easier to detect than the boundaries on bigger socio-economic systems, such as continental or global systems. Also, because the Maldives is such a flat and small country, the consequences of climate change will be visible earlier than it will be visible on a continental or global scale. Therefore, the systems present on the Maldives can act as a model for broader and bigger systems in our world. Since climate change is imposing a huge threat on the future of mankind, studying the islands of the Maldives is interesting and relevant.

This paper aims to show in which ways islands can act as models for other systems present on our planet. The three case studies will each individually show a perspective of how the concerned island fulfilled this role. The book chapter will end with conclusions that can be drawn, lessons that can be learned and a discussion.

Papers

Case study one

Can gated the gated community in metro Manila be regarded as an island?



Name of Island: Island Luzon, Philippines

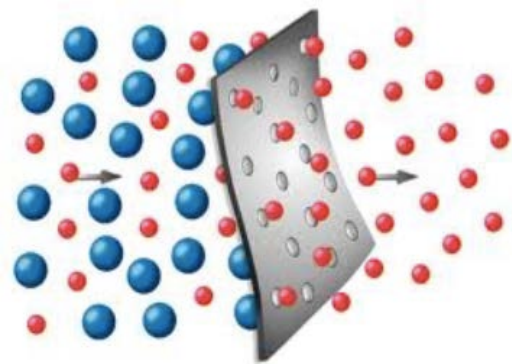
Topic: Social economical and geographical boundaries in Metro Manila

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Introduction

One might have various images, when the word 'island' is pronounced - depending on one's background. But one thing that is common for all islands, regardless of their size or inhabitation, is the sense of isolation. As Dr. Kenneth F. Rijdsdijk states: "despite the wide diversity of islands, they do have some features in common such as 'relative isolation'". Isolation is understood as a separation from another asset. Islands are mostly thought to have water as a boundary, which results in being separated and isolated from the mainland. This aspect is not only experienced by humans, but can also be observed and studied with the islands' biodiversity. Only the organisms that have features that allow them to reach the island are present on it. That is either by active dispersal (flying) or passive dispersal such as floating terrestrial organisms, rafting of terrestrial organisms or wind dispersal (Menken, 2015). The situation have changed since humans started to travel by ships, while some islands, reachable by swimming or walking, have been inhabited even before the boats. Needless to say, the bridges can break this geographical isolation and separation. Still for islands that are too far from the mainland, the access limitation remains. Reaching the mainland is not only a challenge but also a cost (Royle, 2015). This characteristic is a drawback for some to live there. For others, it is a wanted aspect - to retire from this high-speed connected world. The idea of a little island fits just perfectly to this desire. Islands are in fashion again, because they provide a sense of privacy (Royle, 2015).



In a larger sense, Fernández-Palacios (2010) defines islands as being "in relation to a focal individual, population or species, as any favourable place located within a surrounding hostile environment". If we take the example of a guard from a prison island – he might not perceive the island as isolated, as he can reach it, and leave it when his shift is over (Norder, 2015). On the contrary, the prisoner might have the sense that not only the island is an island, but the prison itself, as he can not leave it. As we can see on Figure 1, one that can freely go and

Figure 1. (Norder, S.J., powerpoint presentation course Islands: Models for our Planet – Metaphors for our World)



leave a place does not question its isolation, unlike the one having limited access to a place or the possibility to leave it. Island is here understood as a metaphor for isolation.

As argued before, the restricted accessibility can also be seen positively. When the distance from the city, the busy roads and the pollution is wanted, this is positive active isolation. Another and more controversial example of active isolation is the one from the masses and disorder (crime, squatting density, noise, stink, unsanitary conditions); when a group of people create for themselves a 'better' place¹ to live in (Garrido, 2013a).

¹ Place is here understood as a result of a bounded geographical entity, in addition to investment of human attachment, loyalty and meaning. (Hay, 2006)

Let's look into an example of island country. The Philippines is a country comprised entirely of islands. It is geographically situated in the Pacific Ocean and is known for its 7107 islands. Some of them stretch over several kilometres such as Luzon and Mindanao, while others are just tiny islets. In such a country with endless opportunities for isolation and segregation, the wealthy individuals of the capital have built themselves "a city within a city" (Garrido, 2013a). This new city is called Makati and it derived from globally-linked economical growth, westernization and real estate power (Garrido, 2013a).

These new 'wealth islets' don't have waters as boundaries but walls and gates. For this reason, they are regarded as gated communities. In the Philippines, they are called subdivision, more specifically in Metro Manila, they are known as 'villages'. Together, they have all the features of a city, meaning a self-contained community, including residential parts, commercial and industrial sectors (Garrido, 2013a). Such new 'islet' amidst the capital can be perceived as "a city within a city".



Having in mind the features of islands (described above) this paper Makati and the rest of the 'villages' can be regarded as economical, social and geographical sense. Further more Shatkin (2006), the planning of cities is nothing more different historical junctions of different political leaders position of power. Thus the paper will scrutinize the influences from abroad that shaped Metro Manila urban planning - first, by the Spanish colonizers, then by the Americans and at last the Filipino elite themselves. A greater importance is given to the American occupation as its influence continues until today and distributes its 'soft power' in the country. Soft power is understood as the disclosure of values, standards and culture. Furthermore, Makati's emergence is studied and its evolution in an exceptional way compared to the rest of the city in an economical and social way.

questions whether an island in an and as claimed by than the reflection of to legitimize their great significant

Figure 2. Location of the Philippines and Metro Manila (www.globalawareness101.org)

The Spanish City Intramuros and the Modern Architecture of the Americans

Small islands usually cannot resist the influence of more powerful external powers (Royle, 2015). This can be seen in the Philippines in various ways, while the colonization by the Spanish in the 16th century is one of the most important examples. The Spanish constructed the city of Intramuros, which as seen on the painting (figure 3) and indicated by its name, is a city in-between wall. This city (nowadays in Manila, Philippine's capital) then became the Spanish capital on the Asian continent (Porio, 2009).

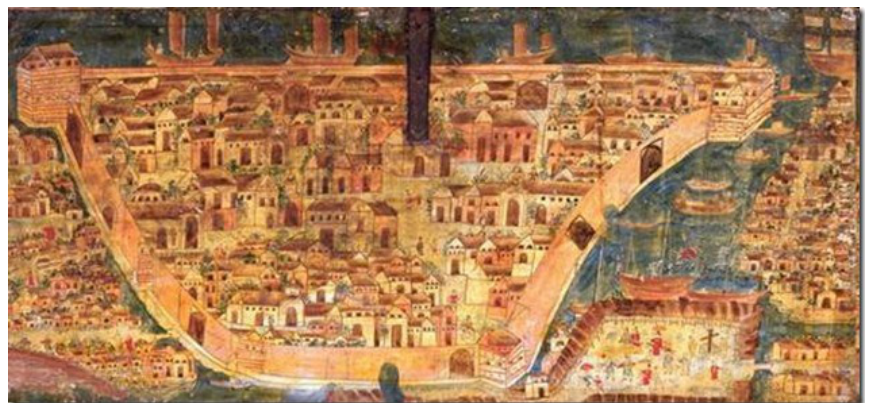


Figure 3. Intramuros (<http://www.aenet.org/manila-expo/page11.htm>)

The United States won over the Spanish dominance at the end of the XIX century. In order to understand this power duality between the colonizer and the colony, it is important to seek the influence of the American urban planning in Manila. Being on Filipino territory, the Americans wanted to introduce Western or ‘civilized’ architecture in the country. Various plans that manifested the American presence were proposed, including big streets and boulevards, which should allow getting easily from one district of the city to another; the city needed a sense of ‘familiarity’ for the colonizers and their measure of ‘comfortable’ (Brody, 2001).

The 89 lots of land that were kept for residence purposes were sold to the powerful and wealthy (Brody, 2001). These slots were thought to create a system of power - “a scopic power of being able to see and survey the colony” (Brody, 2001). Build upon a hill, the residence had a perfect view over the city. In order to understand this model of power throughout architecture, we will need the Panopticon model of Michel Foucault (1975).



Figure 4. Panopticon of [Presidio Modelo – Isla de la Juventud, Cuba](http://scarletimprint.com/2015/03/beneath-the-rose/) (http://scarletimprint.com/2015/03/beneath-the-rose/)

As the study on Panopticon is abundant, only the architecture part will be considered in this paper. The main idea of the panoptic is to exert with a small amount of individuals, power with a minimum of effort. The prison build in a panoptical architecture can be seen in Figure 4. The guard in the tower in the middle of the round building, can survey each prisoner cell perfectly well, due to the light game (outside-in). The idea behind this architecture is that in the end a guard is not even necessary, because the presence of the guard inside the tower is unknown to the prisoners. A more common example is the open-space

office, where every employee can observe their colleagues activity. Without noticing, a controlling atmosphere is build – everyone is policing over others – guarding that everyone works. In the case of Manila, the imperialist idea of the Americans was not to build a watch tower, but the architecture disposal close to Foucault’s architecture model. In the Panopticon, prisoners are forced to see that they are being controlled. Burnham’s imagination of Westernizing Manila had the same idea of spatial regulation (Brody, 2001). The architecture of the capital was an asset for the colonizer to control their new colony. Due to the WWI, this plan was not realised and what remained from it, is a hotel and the Burnham Park (Brody, 2001).

Makati, 7107 plus one island

During the WWII the capital with its historical Spanish center was destroyed to the ground (see figure 5), putting Manila in the second position (after Warsaw) of the most demolished cities in the world (Garrio, 2008). In 1946, the Philippines got their independence from the United States. During that time, there was an important feeling of nationalism, and a sense of a new beginning for the country. The relationship between urban development and



Figure 5. Ruins of San Luis Terrace, Manila Philippines 1945 <https://www.flickr.com/photos/johntewell/sets/72157622715038247/>

national identity in the postcolonial urbanism studies have been considered to be important (Garrio, 2008). The opportunity to build a totally new modern city was huge - a paragon city for the future development of the nation.

In the same years, Rostow's modernisation theory influenced heavily both the economical and the development worlds (Greig, Hulme and Turner, 2007). It emphasized that all countries with their own speed will rise from the stage of 'traditional society' to the fifth stage - 'the age of high consumption' (Timmons Roberts and Hite, 2000). United States and Western Europe being classified in the fifth stage by Rostow, placed the 'rest' of the world in the position of 'catching-up' ever since the 1950's (Greig et al., 2007). Tradition was seen as an obstacle to progress and therefore - unwanted. Industrialization meant winning over tradition; consequently, economical growth and Gross Domestic Product (GDP) became a measurement of well-being among countries (Greig et al., 2007). After Japan and Malaysia, the Philippines were among the countries with highest GDP in Asia, having put the globalized economy as their priority (Balisacan and Pernia, 2002).

In order to have high GDP, the Philippines relied on the concept of Global cities (Garrido, 2013a). This concept lies on advanced corporate services, which require two kinds of labour - very skilled educated workers and cheap (poorly educated) labour. The wages and working conditions of those two kinds of workers are reflected in the society and throughout the city. This duality could be the result of the global market with its low regulation and free market. Indeed, the GDP only measures the economical growth, and not the high level of misery that was and is still present in the Philippines. Metro Manila hosts a few rich people, concentrated in Makati and the majority of the population is economically poor. Makati became the financial city center, alongside exclusive gated communities, expensive hotels, and other high-end consumption spaces (Porio, 2009).

Makati and its history

Today's financial district of Makati only developed in the 1950's (Porio, 2009). It was once occupied by cabarets, cockfighting and prostitution. But after 80% of the city was demolished by the American bombing, it brought the opportunity for new planning and construction. Already emerged during the colonial times with the city of Intramuros, the separation between the elites and the mass was expected.

A similar plan was applied for Makati. Displaced by the war, lots of migration squatters came to the capital, which drastically increased the population of Manila between 1939 and 1948 (Garrido, 2013a). The territory of the future Makati was then occupied by 500 squatters' families and their rice paddies. But instead of giving these people shelters to live in, it was decided to create a space that would attract Manila's rich. The plan was clear - to build a new town, with integrated residential, commercial and industrial districts, with parks, schools, hospitals and churches (Garrio, 2013a). For this purpose, the immigrants from the countryside, who had built their shelters there, were removed by the Ayala real estate family.

Garrio (2013a) stresses that the dual city was not created only by the global economical force. It is also due to the local real-estate markets. He supports the idea that modernist urban planning is in the imagination of the one building the city and also in the representation of the cities' elite. The rise of the new city - Makati is understood by the author as the emergence of a segregated city.

Geographical boundaries

Not only in the 1960's but also in the 1970's the 'salami approach' was applied for Old Makati city construction. Meaning that low-cost, minimally provisioned subdivisions were built, which could be sold cheaply and quickly. It was randomly erected because each 'slide' of the land was sold regardless of what would be built on it. This social order was deeply desired by the rich community of Metro Manila and resulted in a planned separation between them and the poor population.

Nowadays, a picture of the city from above clearly shows where the New Makati is. Even geographically it is possible to distinguish the boundaries between this neighbourhood and the rest of the city. New Makati was meant to be "a suburban adjunction to Manila but still be a social and clean separation from it"(Garrio 2013a, p. 170). As seen on Figure 6, the borders between the nice green areas and the nice spacious houses are clearly visible. In a sense, this segregated areas from the rest of the inhabitants of Manila, can be seen as a Paradise Island in the middle of the diligent reality of the capital.



Figure 6. McKinley West and Hills
(<https://homepropertyfinder.wordpress.com/2011/05/27/prime-lot-in-metro-manila-beside-forbes-park/>)



Figure 7. Fobres Park
(<http://www.lamudi.com.ph/journal/metro-manilas-expensive-subdivisions-buy-home/>)

Economic boundaries

Fobres Park (the first built 'village') was planned for the upper class, with 250 sq. meter lots for houses, with wide roads, underground drainage and a functioning water system. This area even has its own golf course with its own helicopter pad (Garrido, 2013a). Fobres Park is now a symbol of certain quality of life that one can obtain in the Philippines.

After Fobres Park's success, five other 'villages' were built by the Ayala real estate in the following ten years. Certain conditions were imposed. In order to have green areas, something rare and valued, the houses could only occupy 30% of the

lot (Garrido, 2013a). They had to be built from strong materials and occupied by a single family. All the villages had the same standards and services as Fobres Park: power lines, paved streets, plumbing, garbage collection, street lighting and security. All in all, it was reflecting the minimum standards of a modern and orderly community (Garrido, 2013a).

It created geographical separation between two classes presented the existence of two distinguishable communities (Garrido, 2013a). This strategy of walled, residential subdivisions (gated-communities) called 'villages' became a model for urban development, as seen on figure 7.

This type of architecture goes beyond the Western model and aims at exclusivity. In 1995, Glenda Gloria, a journalist reported that the city was one, but within two worlds. Garrio (2013a, p. 182) observed: “Makati is a dual city where the rich and poor live cheek by jowl but worlds apart”.

This observation can be understood with the following information. Makati’s area is 4% of the capital, home to 40% of the top 1’000 corporations in the country, 54 embassies, 35 consulates and 12 international organisations. The Japanese Human Development Index is close to the one of Makati, however it’s faraway from the rest of the Philippines’ HDI (Garrido, 2013a). Makati’s greater importance pushed a radical student in the 70’s to declare “in order to destroy the Philippines economy system, all one had to do was take out Makati” (Garrido, 2013a, p.167). Today, one-third of the country’s total GDP is accounted there (Porio, 2009).

Social boundaries

Going to Makati, for many residents from Metro Manila, means crossing a social boundary. “New Makati was meeting the counter arts of the west” (Garrido, 2013a, p.169). It formed to create socio-spatial and cultural inequality. Being inside the walls of Makati is not only about one’s wealth but it gives a clear feeling of either belonging to *masa* (the mass) or *di masa* (not the mass). These two classes are defined through a specific lifestyle, the consumption and use of goods (Garrido, 2008). Cultural distinctions and the symbolic struggles of the individuals depend on the economical class division. This common disposition and common conditions create feelings of belonging to a group (Garrido, 2008). As a result, New Makati is differentiated from the ‘masa’ by its clear geographical, economical and social boundary.

“Social islands may be simply defined as relatively small groups of people who consider themselves, and in important symbolic and behavioural indicators are indeed, separate from other groups both horizontally and vertically in the social structure, and are usually also discrete in space and time as well; although separate, social islands are however related to the larger social context (the sea) and to mainland (larger societies)” (Pitt, 1980). The author argues that this social island can also be found in a city, such as in Metro Manila. The rights and the resources (economical boundary) are indeed unequal but probably the most felt way of exclusion is the “everyday practice that continually reproduces a defined measure of social distance” (Garrido, 2008, p. 448-449). Thus it can be argued



Figure 8. Slum area
(<http://agoodgame.blogspot.nl/2013/07/on-poor-and-metro-manila-slums-rage.html>)

that the strongest, social distance is created between *di masa* and *masa*. The feeling of exclusion, ironically from the ‘the sea’ (the mass) is felt, and the active isolation was built by ‘*di masa*’ to become ‘islanders’.

Some examples of the social distance can be easily observed – like the language spoken within Makati and the rest of the city. English is spoken in Makati and the ‘villages’ because it is seen as more ‘classy’ – coming from the United States (Garrido, 2008).

The main interaction between the two worlds

occurs in the context of employment relationship. These two worlds can be seen in figure 8 – squatters (slums) and residents of ‘villages’ (gated communities)². Squatters work in the villages as cooks, nannies, laundrywomen, drivers, gardeners, plumbers, manicurists, etc. Not only, describes Garrio (2013b) are the squatters separated spatially in the city, but also in the household. At the workplace, under the prescription of the owner, the movements of the squatters are limited. For example, the main door is only used by the owners, the servants have to use the back door; the cook can only be in the kitchen, any other places in the house has to be justified by a task. A ‘purpose’ is always needed for the right to be allowed to be somewhere (Garrido, 2013b). “A resident of one of the poorer areas (...) may never set foot inside the Greenbelt mall in Ayala Center merely a few kilometres away from where he lives; were he to enter the mall, he may suddenly find himself feeling out of place, even ashamed” (Garrido, 2013b, p.178).

This is how the distance wished is put into daily practice, and into feelings. Garrido (2013b) stresses with the studies of Bourdieu that exclusivity or stigmatization does not need anymore to be guarded, by a gate, because it has become a practice from both sides. The outcome is close to the one of the panopticon architecture.

This practice conveys in keeping apart people recognized as categorically unequal. The place function is linked cognitively to the place practice making. This is why connection between place, function and practice, is not only reproduced, but goes beyond, in all urban spaces, where class interaction may occur (Garrido, 20013b). Villagers can therefore claim their superiority, not only because they are wealthy but simply because they live ‘inside a village’, compared to others who live ‘out there’ (Garrido, 2013b).

Conclusion

As Peterson (2015) states, islands are dualities. The island-ness is an ambiguous concept (Jakson, 2008). It covers the openness of an island with the wider world, but also the closure of it within its clear boundaries. Boarders give this sense of insularity and isolation. Insularity is not only defined as the state or a condition of being on an island, but also as a lack of contact with others. This state of island-ness can be easily broken, if one has the possibility to leave or reach the island. Thus, everything lies in this possibility.

In Metro Manila, exactly this possibility is not given to all its population. Certain part of the population not having access to Makati and the 6 ‘villages’, can be seen as the lack of feature of some species to reach an island. For some Manila is composed of wealthy islands. Squatters are not welcomed in these neighborhoods and are actively hold outside. The lack of contact with squatters indicates the total rejection of this population and creates segregation and isolation between them.

Islands and their island-ness only exist in contrast to the mainland and the duality between them. As Hau’ofa (1994) stresses “it was continental men, Europeans and Americans, who drew imaginary lines across the sea, making the colonial boundaries that, for the first time, confined ocean peoples to tiny spaces. These are the boundaries that today define the island states and territories of the Pacific, I have just used the term ‘ocean peoples’ because our ancestors, who had lived in the Pacific

² This names (squatter & villager) are not given by the Garrio (2013b) but by the fliipinos among themselves.

for over 2000 years, viewed their world as a 'sea of islands', rather than 'islands in the sea'."

As much as the Spanish and the American, the Filipino elite created and built their island. They actively isolated themselves in 'islands'. As Shatkin (2006) emphasises, the planning of cities is nothing more than the reflection of different historical junctions of different political leaders to legitimize their position of power. Power holders have changed in the last couple of centuries, and it is very likely that a shift will occur also in the future. Thus, it is important to put importance to the wise words of Meadows et al. (2009, p.99): "*It's a great art to remember that boundaries are of our own making, and that they can and should be reconsidered for each new discussion, problem, or purpose.*"

Case study two

The threat of climate change on socio-economic systems:
Case study of the Maldives



Name of island: The Maldives

Topic: Influence of climate change on the socio-economic system of the Maldives

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Amount of words [excluding reference list] 3517

Introduction

The Maldives being the flattest country in the world (Khan et al., 2002), is extremely vulnerable for the impacts of climate change. Alterations in sea level, storm activity, swell, sea surface temperature and ocean acidity risk the presence of a safe and economically successful future for the 300,000 inhabitants. The capital of the Maldives is Malé and the country consists of approximately 200 islands (Naylor, 2015). The total area of the Maldives is 235 km², which makes the Maldives the sixth smallest sovereign state (Shaig, 2006). An indication of where the Maldives is located can be found in figure 1.

Via literature research, this paper examines the consequences climate change has on the socio-economic system of the Maldives. This system consists out of eight different sectors namely; human settlements, fisheries, coral reef biodiversity, tourism, critical infrastructure, water security, food security and human health. These sectors are chosen since they are the most vulnerable sectors for the influences resulting from climate change because they provide the most jobs and are the most important for the economy (Sovaocool, 2012).

Since the Maldives consists of small islands, potential and direct effects of climate change can be easily detected and examined. The Maldives can be seen as a model for the bigger continents because they can be seen as simplified versions of our planet (Warren et al., 2015 & Norder & Rijdsdijk, 2015). Impacts of climate change are easily visible in the Maldives and therefore they can be used to predict how effects will be on continents and other parts in the world. This knowledge is relevant since the impacts of climate change will only increase in the future. Furthermore, decision makers should be well informed of the possible risks which they are approaching.

Therefore the question is raised; how does climate change negatively influence the socio-economic system of the Maldives? First, the eight most vulnerable sectors in this system are examined separately. Here the influences of climate change on the sector and their corresponding effects are discussed. Hereafter, a short overview is given of what can be done to improve the resilience of the sector. Finally a conclusion is drawn.

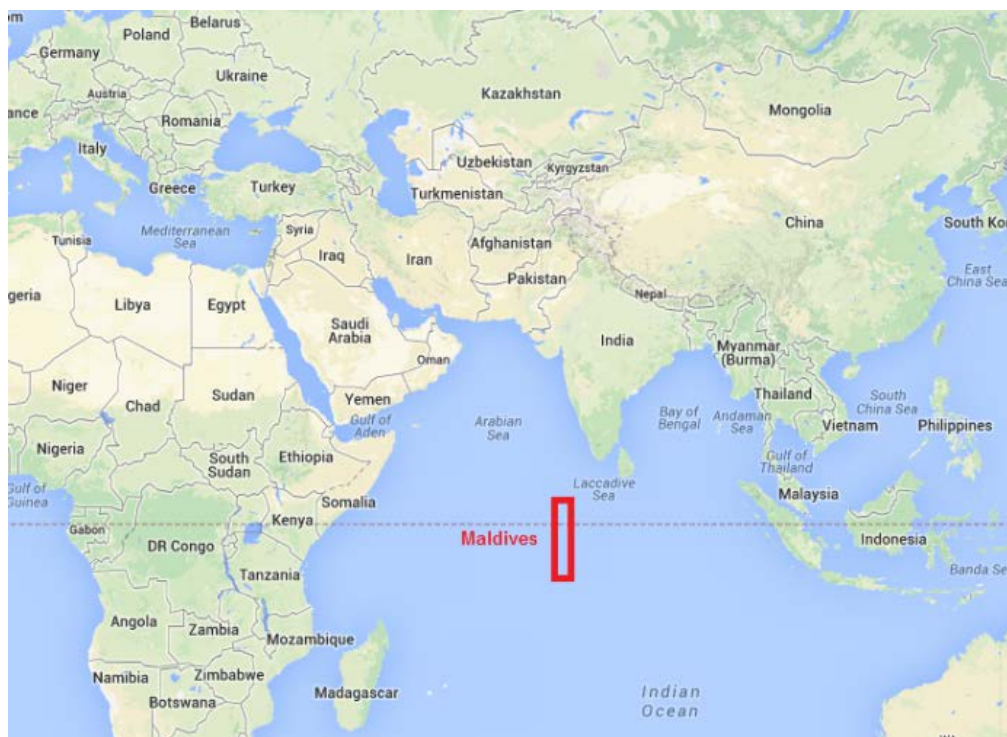


Figure 1: Location of the Maldives (Maldives Finest, n.d.).

Impacts of climate change on the Maldives

The impacts of climate change on different sectors in the Maldives can be examined when subdivided in eight groups: human settlements, fisheries, coral reef biodiversity, tourism, critical infrastructure, water security, food security and human health. These groups are primary sectors which are the most vulnerable to the influences of the current climate change (Sovacool, 2012). They will be discussed separately.

Human settlements

The first sector is human settlements. These are mostly at risk through sea level rise. The Maldives is one of the most vulnerable countries in the world for the impacts of sea level rise because of its small size, its unconsolidated nature and its extremely low elevation (Shaig, 2006). In the recent years, there has been a rising trend of the sea level in the Maldives. For instance, the annual trend is a rise of 4.1 mm per year for the island Malé, and 3.9 mm per year for the island Gan. The rise in the Maldives exceeds the global rise, which is 0.3-3.0 mm per year (Khan et al., 2002).

As can be seen in figure 2, the Maldives consists of many islands. Since the inhabitants are living on small islands, they are forced, through geographic and geophysical constraints, to live close to the sea. About half (47 percent) of all houses of the local communities are located within 100 meter of the ocean (Sovacool, 2012). This makes the local communities extra vulnerable for the effects of sea level rise. Even living more land-inwards does not guarantee protection against the ocean. Approximately 80 percent of the total area of the Maldives lies less than one meter above sea level (Republic of Maldives, 2007).



Figure 2: Map of the Maldives (Sea See Travel, n.d).

Floods occur very often. For instance, in the period from 2000 to 2006, 90 inhabited islands were inundated of which 37 on a regularly basis. In 2007, sea swells have destroyed 500 houses, by flooding 68 islands of the Maldives. This event resulted in an evacuation of around 1600 inhabitants (Sovacool, 2012).

On these small islands the ocean is always nearby, which makes it impossible to flee from it. Also, since the Maldives is the flattest country on earth, it is impossible to escape to mountains or other higher areas in the landscape. When the rising ocean forms a direct threat, evacuation from the islands seems to be the only solution to rescue the inhabitants. The sea level will continue to rise, therefore floods will continue to form a significant problem in the future (IPCC, 2014).

In order to protect the human settlements, investments should be made in (natural) defense systems which can protect the coastal area from flooding, such as the construction of levees. The floods should be taken into account while planning and building the houses. Ideally, houses should be built that are resilient to floods, so that when they occur, damage is minimized.

Fisheries

The second sector is the fishery. Many islands are dependent on fishery partly because they have severe limitations on the availability of resources on their own land. Therefore they use the ocean to enhance their resource availability, in this case for fish (Royle, 2015). The Maldives is surrounded by an ocean full of fish, on which one-fifth of the population depends for their main income. Almost 30 percent of the total fish capture is used for food for the local population, a small part is used by tourists and the rest is exported. This export is very profitable and the Maldives earns approximately \$100 million from the export per year (Sinan & Whitmarsh, 2010). The most important fish, which are caught for food, are the yellow fin tuna and the skipjack tuna, which comprises 70 percent of the total catch (Chandrappa et al., 2011).

However, the fisheries in the Maldives are part of a broader system: the wider Indian Ocean fisheries. Therefore, climate induced problems and overexploitation elsewhere in the ocean, can influence the fisheries in the Maldives itself (Republic of Maldives, 2007).

Changing ocean temperatures as a result of climate change are keeping the fish away from the islands. Especially the tuna is influenced by change in biophysical conditions of the pelagic environment. It is particularly sensitive to the El Niño Southern Oscillation and changes in sea surface temperature. The changing climate influences the sea surface temperature and therefore also the availability of sufficient fish (Sinan & Whitmarsh, 2010 & Singh, Khan, Aktar & Sarker, 2001).

In order to guarantee continuity of the fishing industry, fisherman should consider establishing mariculture, the cultivation of marine organisms in the open ocean, for the production of fish (Republic of Maldives 2007). In this way, the availability of fish will be guaranteed. Also, the fisherman could choose to capture other fish species, which might not be as sensitive for climate change as tuna is.

Coral reef biodiversity

The third sector is the biodiversity of the coral reefs. The coral reef area of the Maldives covers approximately 4513 km². This makes it the eighth largest reef system in the world (MRC, 2011). More than 1900 different fish species are present in the reefs and they host 187 different species of coral. This makes the reefs one of the richest in the world in terms of biodiversity. The population of the Maldives depends strongly on the coral reefs. The reefs are important for attracting tourists and to support the fisheries which are, as said before, an important source for food (Jaleel, 2013). The reefs also fulfill an important task of protecting the shoreline against storms (Hoegh-Guldberg et al., 2007).

However, the reefs are extremely vulnerable to climate change. Especially the corals are sensitive to fast changes in temperature, salinity and carbon dioxide concentrations in the ocean (Jaleel, 2013). When CO₂ concentrations in the atmosphere increase, this can result in increasing temperatures in the ocean. If the sea temperatures rise too fast, the corals are not able to adapt and coral bleaching may occur (De et al., 2015).

An increase in CO₂ concentrations in the atmosphere also results in acidification of the ocean. Around 25 percent of the anthropogenic carbon dioxide emissions is absorbed by the ocean. Here the CO₂ will react and turn into carbonic acid. When the pH of the ocean decreases, calcium carbonate dissolves. Calcifying organisms, such as corals, need calcium carbonate for calcification (Hoegh-Guldberg et al., 2007). When anomalous situations occur, a tipping point can be reached in which coral reefs change in an algae dominated reef. When this happens, turning back into a coral reef is very difficult (Hoegh-Guldberg et al., 2007).

In 1998, due to warming events, the Maldives had one of the heaviest coral mortality rates in the Indian Ocean. In addition, in 2003 and 2010 sub-lethal thermal deviations occurred, which have damaged the reefs (figure 3). However, currently no reefs have turned into an algae dominated reef yet. Therefore the tipping point is not yet reached (Tkachenko, 2015). This indicates that if from now on the sea temperature does not deviate too much, and the coral bleaching threshold is not passed, the coral reefs might be able to slowly recover from the damage. However, since global warming still continues, this is not very likely.

Instead, further warming and acidification of the sea can be expected. The higher the CO₂ concentrations, the more negative the effects may be (figure 4). This can lead to even more dramatic socio-economic effects for the tourist sector and the fisheries in the Maldives and even less protection of the shore line against storms by the reefs (Hoegh-Guldberg et al., 2007).

It is difficult, if not impossible, to protect the coral reefs from the acidifying water and the rising temperature. More research about the effects could be done. Also, it is important that other stresses imposed on the reefs should be minimized. For instance, the effects of mining of the corals for using it as constructing material and the pollution of the reefs should be as low as possible.

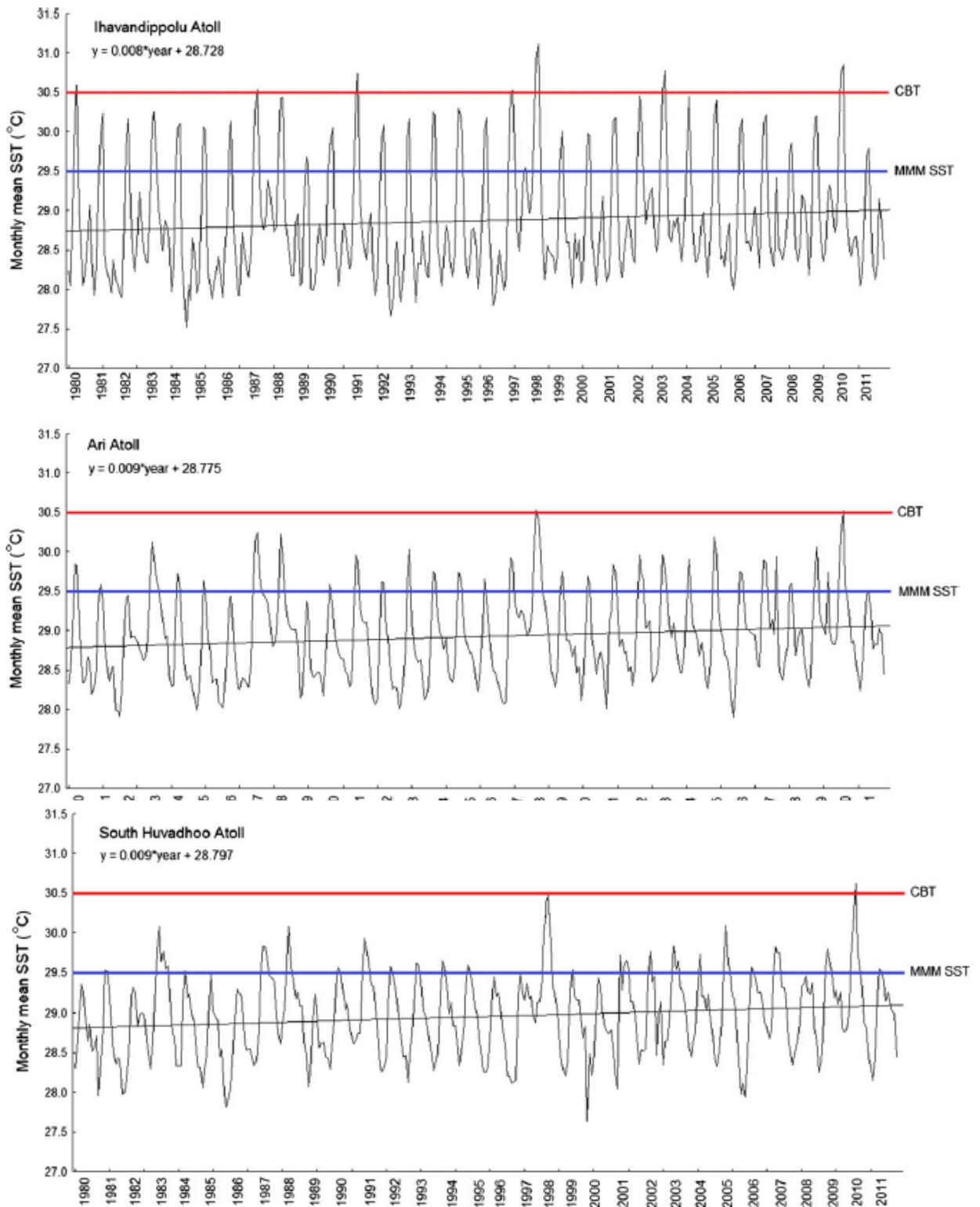


Figure 3: The monthly mean sea surface temperatures from three different locations on the Maldives from 1980 up until 2011. The CBT (coral bleaching threshold), the MMM SST (maximum monthly mean sea surface temperature and a line for the average rate of temperature increase are given (graphs from Tkachenko, 2015).

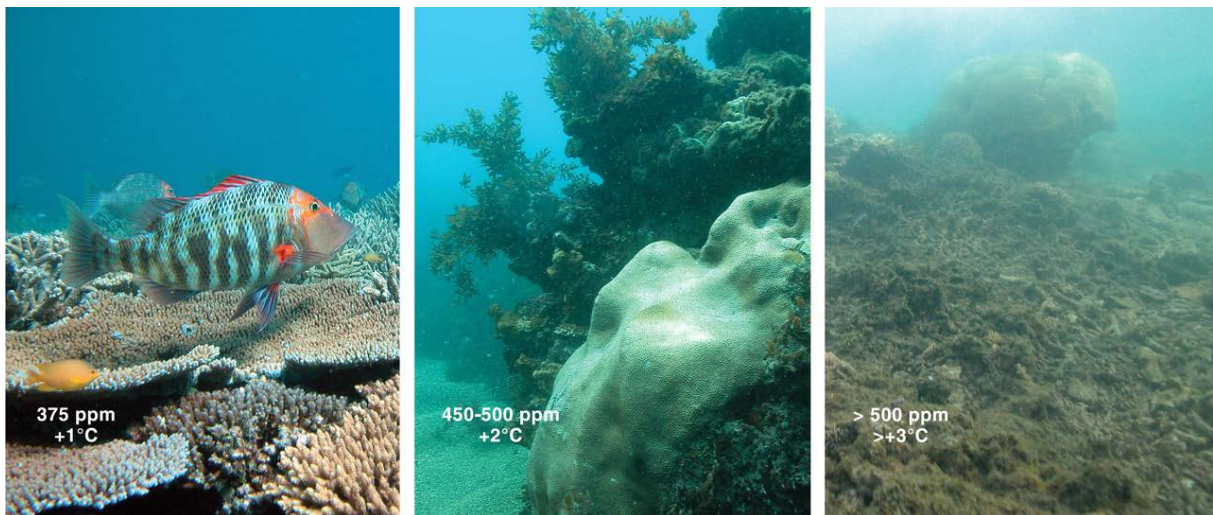


Figure 4: The impact on corals of rise in sea temperatures through increase in CO₂ concentrations in the atmosphere. On the bottom of the images the different concentrations of CO₂ in the atmosphere are shown with the corresponding temperature rise. Source: Hoegh-Guldberg et al., (2007).

Tourism

The fourth sector is tourism. Tourism is the fastest growing and most dominant economic sector in the Maldives. Around 17000 direct jobs are in the tourist sector and it contributes to one third of the GDP. This sector also provides many indirect jobs (Republic of Maldives, 2007).

Tourism is one of the most vulnerable sectors for climate change. The tourists are typically attracted by the white sandy beaches, and the coral reefs, however these are under a great threat. This endangers the diving operations. The rising sea level results in erosion of the beaches and pollution of the groundwater, which damages the vegetation at the resorts.

The tourist resorts themselves are highly vulnerable for the influences of climate change. In most cases, only one resort is present on one island. The smallness, geographical dispersion and low elevation of these islands forms a great threat for the resorts located on them (Sovacool, 2012).

Sea level rise, with its resulting damage to the coral reefs, is the main factor resulting from climate change that directly harms the tourist sector. Most other risks are indirect, but can still have a great impact. For instance, impacts on infrastructure can cause great damage when the main airport in Malé gets unservicable through sea level rise, since 99 percent of all the tourists travel through this airport (Republic of Maldives, 2007). Other sectors that can be influenced by climate change and therefore impose risks on tourism are the fisheries, agriculture, water resources and human health.

In order to guarantee tourists in the future, the areas that attract the tourist should be protected. Everything should be done to maintain the beauty of the beaches and the reefs. Also, resorts that are going to be built should be built climate change proof, for instance resilient to flooding. The Maldives should reduce their over-dependency on the coral reefs (Republic of Maldives, 2007), and should stimulate other tourist attractions. This will reduce the damage on the marine environment, and it will attract a larger and more diverse audience to the islands.

Critical infrastructure

The fifth sector that is impacted by climate change, is the critical infrastructure of the Maldives. This sector includes all the roads present on the islands, but also the airports, harbors, schools, electricity networks, waste management and so on. The main threat for this sector is the effects of sea level rise. 99% of all infrastructure necessary for the resorts is located within 100 meters of the coastline (Sovacool, 2009). Structures are on average built 1.6 meters above main sea level, and over-water structures are built above the average highest tide (Republic of Maldives, 2007). These adaptations might not be good enough, since the sea level is still rising, and storms will occur more frequently.

Two major flooding events occurring in the last 50 years, in 1987 and 2004, have already shown how big the impact of floods can be in this sector. The flood of 1987 occurred due to very high swell and caused around €42 million of damage on the international airport on Malé alone (Naylor, 2015). In 2004, a tsunami occurred, which caused a damage to transport and communications infrastructures of €18.7 million (WB, ADB & UNDP, 2005). Tsunamis may not be caused by climate change, but their impacts might be higher if the Maldives are stressed by an overall higher sea-level. Also, the effects of a tsunami are a good example of impacts that major floods, caused by climate change, could have.

Since the tourist sector in the Maldives is only becoming more important (Naylor, 2015), it can be expected that the amount of critical infrastructures is going to increase. Therefore, more damage can be expected in this sector.

In order to make the critical infrastructure of the Maldives more resilient, more time should be invested in ensuring a resilient design and plan for infrastructure that is going to be built (Republic of Maldives, 2007). Also coastal protection of the most essential infrastructures, such as the main airport in Malé, is necessary.

Water security

The sixth sector is water security. In order to ensure enough fresh water, the Maldives uses different sources, namely, groundwater, fresh water aquifers and rainwater. The freshwater aquifers lie approximately 1 to 1.5 meters below the surface of the islands and are a couple of meters thick. However, these aquifers and the groundwater are highly endangered, not only by land surface pollution and drought, but also by sea-level rise. Intrusion of salt water from the ocean is contaminating the water reserves (Baily, Khalil & Chatikavanij, 2015).

Therefore, rainwater is now the main source of drinking water in the Maldives. The annual average rainfall in the Maldives is 2124 mm. The Southern atolls receive notably more rainwater than the northern islands. Climate change does not have a beneficial effect on the rainfall for the Maldives. Even though the global average of rainfall is expected to increase, a decrease is expected for the Indian Ocean. This decrease can impact the possibility of harvesting enough rainfall for the use of drinking water (Nurse & Sem, 2001). During dry periods, drinking water shortages are, and will be in the future, a huge challenge for the Maldivians, especially for the inhabitants of the northern islands.

If the Maldives were located on a continent, it would be much easier to receive drinking water from another area by pipelines. However, the Maldives consists of small islands located in the middle of the Indian Ocean. Receiving enough water from the continents therefore seems almost impossible.

It is difficult to make this sector more resilient to climate change. However, actions could be taken to improve the resilience of this sector. Sewage treatments and disposal technologies can be built

which protect the water resources from the invading salt water (Republic of Maldives, 2007). Also, natural water catchment areas should be protected and new ways to harvest drinking water should be used, such as the desalination of sea water. However, since desalination is quite expensive, techniques which can ensure a cheaper way of desalinating sea water should be innovated and used.

Food security

The seventh sector is food security. The sandy soils of the Maldives are of poor quality, mostly because of the absence of silt and clay. The total estimated area of land that can be used for cultivation is only 27 square kilometres. The main crops that are cultivated are crops like bananas, watermelons, mango's, cucumbers and coconuts (Sovacool, 2012).

A big problem for islands in general is decision-making about spatial organisation. Urban development, other development of sectors and infrastructure are constantly in competition with each other for claiming the limited space present on the islands (Royle, 2015). Therefore, finding more land which can be used for agriculture is a complicated process.

Due to this lack of space and in combination with the infertile soils, the Maldives has to import great amounts of food from other countries. This import also includes crops which the Maldives can actually cultivate themselves, but in too small quantities. Since the mainland is far away, import is mainly done by big ships. The difficulty of importing food may also influence the prices of the food. Almost all food items are imported, except for coconut and fresh Tuna. This huge dependency on import makes the Maldives also vulnerable for effects of climate change in other countries (Republic of Maldives, 2007).

Effects of climate change on the food security of the Maldives themselves are changes in temperature, decrease in precipitation and a more frequent appearance of extreme events. These are problems that will be even more damaging in the future. As discussed before, there will be shortages of water in the Maldives through which plants suffer as well. Also, heat may result in heat stress on plants and there will be loss of soil fertility through coastal erosion of fertile topsoil (Republic of Maldives, 2007). The pollution of groundwater through intrusion of salt water may negatively influence the plant growth.

As mentioned earlier, fish is very important for the Maldives and it is one of the main sources for protein for the inhabitants. Therefore, the negative impacts of climate change on the fishing industry will also influence the food security of the country.

Since import is so important for the food security and small islands can usually not resist the influences of more powerful countries outside (Royle, 2015), the Maldives should secure their trade agreements with their trade partners from other countries (Republic of the Maldives, 2007). Also, the Maldives should invest in technologies, such as irrigation techniques which are very efficient in using water, to make local food production more productive and to create new possible farmland areas. This will diminish their dependency on other countries.

Human health

The last sector discussed is the sector of human health. Climate change can, directly or indirectly, negatively influence the health of the population. Changes in temperature and rainfall enhance the change of getting a vector-borne disease. An example is the disease of Dengue. Dengue is becoming more common and there is evidence that it has an association with El Niño Southern Oscillation events (Sovacool, 2012).

Around 20 percent of the inhabited islands of the Maldives experienced flooding at least once a year. The floods can disrupt water systems and sewage, which can cause water-borne diseases such as shigella and diarrhea (Shaig, 2006). Since the amount of floods is predicted to increase, water-borne diseases might cause increasingly more damage to the local communities.

Also, the increase in exposure to UV radiation has caused conditions of the skin, eye and subcutaneous tissue (Shaig, 2006). Therefore the inhabitants should be advised to stay out of the sun when possible, and to wear protective clothes which can protect them from exposure to UV radiation.

In order to protect the inhabitants against water-borne diseases, preventing floods from occurring will solve great parts of the problems. Since this might be difficult, the government should invest in improving the water and sewage systems. Hygiene is important for reducing these types of diseases; therefore good functioning systems could prevent the diseases from spreading.

The regulatory and institutional capacity for vector control should be strengthened and more research should be undertaken in order to find out more about climate related diseases (Republic of Maldives, 2007).

Indirect influences

The direct influences of specific results of climate change are easier noticeable than indirect influences. Since all the sectors are part of a broader system, the socio-economic system, the impacts on one sector may influence another sector indirectly. The complexity of the relationships between the different sectors is given in figure 5.

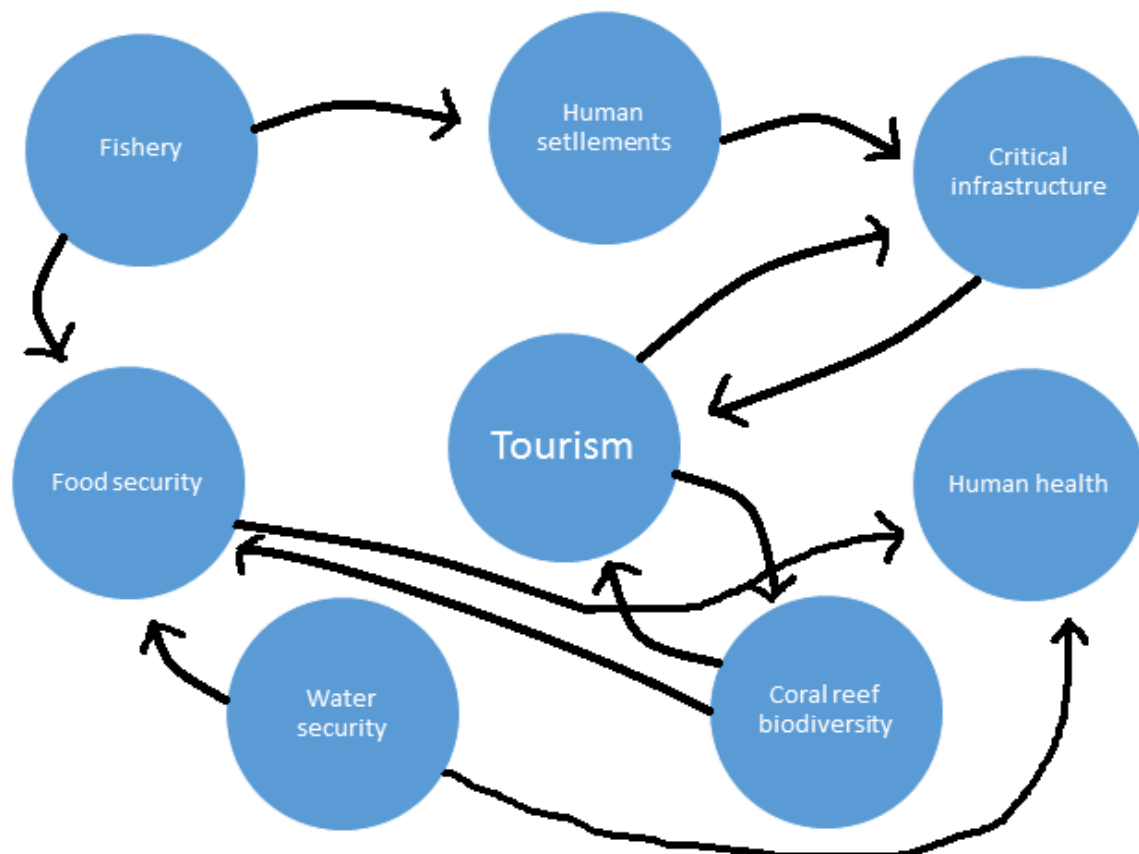


Figure 5: Impacts of climate change of one sector can indirectly influence another sector.

Conclusion and discussion

It can be concluded that climate change influences the eight different sectors in the socio-economic system in a different way. However, all the sectors are connected with each other and thus, apart from direct influences, the different sectors also have to cope with indirect influences of climate change forced on them by other sectors.

Climate change can result in many different negative effects, however sea level rise, change in temperature, change in precipitation and acidification and warming of the ocean are the five effects that turned out to be the most influential on the eight most vulnerable sectors of the Maldives.

Sea level rise, which causes floods, pollution and erosion, directly negatively influences human settlements, critical infrastructure, water security, human health and partly tourism. Changes in overall temperatures of the air mainly negatively influences the food security of the country, by imposing increasing heat stress on the crops and human health by enhancing the spread of vector-borne diseases. A reduction of the annual precipitation endangers water availability, since rain is the main source of fresh water. It also endangers food security, causing drought stress for the crops. Acidification and warming of the ocean highly damages the coral reefs with their biodiversity. Since the marine ecosystem is the most important attraction for tourists, these impacts of climate change almost directly influence the tourist sector as well.

However, there are actions that could be taken to inhibit the negative impacts of climate change, with the most important one being investing in coastal protection to avoid floods.

Since the islands of the Maldives are very flat and small, the effects of climate change can be observed more easily and quicker than on bigger countries or continents. The boundaries present in the socio-economic system are easier to determine since the system acts on a smaller scale. In the same way, influential factors are easier to observe. However, in the long term, effects of climate change can be the same for other islands or other countries. Therefore, the Maldives can be seen as a model for our planet. Knowledge received from this study can be an example of how socio-economic systems in other areas of the world might react to the consequences of climate change.

However, it should be noted that considering the socio-economic system of the Maldives as a model for more socio-economic systems on a larger scale, is an extreme form of simplification. There is a reason for continental and global systems for being more complex because many more factors play an important role in the system. Leaving-out influential factors in a simplified model for a system may create results that differ strongly from results that will actually occur.

Chapter discussion and conclusion

Researching islands helps us to understand the world that we live in. The combination of three different researches has resulted in an interdisciplinary approach for this book chapter. The islands discussed are regarded as biophysical and social (cultural, political and economic) entities. What makes an island an island? How does growing tourism influence an island? And what are the effects of climate change on islands? By answering these questions insights from different geographical disciplines were used. As examined in this paper, an island is not always a landmass surrounded by water. From the study case of Metro Manila it can be learnt that an island can also be a gated community with other ideologies, culture and other socio-economic status. This means that there are many other isolated areas with their boundaries that can be qualified as an island. It is also important to face current and future environmental and socio-economic challenges, since they endanger the quality of life for the future generations. These challenges were discussed in the study case of Boracay and the case study of the Maldives. In these papers the islands had to deal with global warming and with a socio-economic change, partly caused by a rise of tourism.

Islands as a laboratory

In these three cases the islands are used as laboratories. When researching the cases, we used islands to improve our understanding of the ecology and the development of communities. The boundaries on the gated communities in metro Manila and the tourist sector in Boracay are easier to detect than boundaries on comparable systems, since these two systems are on such a small scale. The study of the system of the gated communities in Metro Manila can for instance help with understanding segregation of different communities on a larger scale elsewhere in the world. Learning to detect the differences and relations between the tourists and the local communities in Boracay can help to develop strategies to overcome the rising problems. Also for the Maldives, the boundaries to this socio-economic system are far easier to detect than the boundaries on bigger socio-economic systems such as continental or global systems. Because the Maldives is such a flat and small country, the consequences of climate change will be visible earlier than it will be visible on a continental or global scale. Therefore, the systems present on the Maldives, Boracay and Manila can act as models for broader and bigger systems in our world. In order to get a clear overview of which lessons can be learned from the case studies, the similarities between the different papers are discussed.

Similarities between the case studies of the Maldives and Boracay

According to the research about the Maldives, acidification and warming of the ocean highly damages the coral reefs with their biodiversity. Since the marine ecosystem is the most important attraction for tourists, these impacts of climate change almost directly influence the tourist sector as well. This coral degradation is again examined in the research about Boracay. The main message about coral in the Boracay case is that due to tourism growth, the coral reefs are damaged. In short, both climate change and tourism growth are contributing to the high extent of coral degradation in oceans. The degradation of the coral reefs and the natural attractiveness of islands is thus also influencing the tourism. With the information of both papers it has to be considered that not only the growth in tourism, and not only climate change, are responsible for coral reef damage. The reefs are going to deteriorate much faster because both of the factors are damaging the coral reefs in high extent. This will not only be the case for the islands of the Maldives and the island of Boracay, but

also for other coral reef systems on the planet. Therefore, other countries which are dependent on their coral reef ecosystem can learn from these case studies and consider the resulting effects on the coral reefs as a warning and as a model for their own coral reefs. If it is not too late now, measures could be taken to prevent the occurrence of the negative effects of tourism on the coral reefs in other countries.

Similarities between the case studies of Boracay and Manila

The case study of Boracay also has similarities with the case study of Manila. In Metro Manila the wealthy individuals of the capital 'build themselves' a city within a city. An 'island', where access is restricted. This 'island' has clear boundaries and the rich are separated from the rest of the inhabitants of city of Manila. Boracay is a different type of island. This in the most simple version; a landmass surrounded by water. However, there are similarities. In Boracay it can be said that the rich people, in this case the tourists, also separate themselves physically from the local inhabitants in their resorts and hotels but they also separate themselves in a different way. The tourists are searching for a host of leisure pursuits such as boat trips, windsurfing, diving, playing golf, trekking, mountain-biking and visiting the caves in the hills of the island. These wealthy people are coming from other countries all over the world. In both the cases of Boracay and Manila, the people who have a higher income, and thus another socio-economic status and other cultures and manners. Mostly this is conflicting with the local, poorer people. The hedonistic lifestyle of tourists and the rich people in Manila is in contrast with the more restrained behaviour and budgets of local, poorer people. In the case of Boracay, this difference of social status is connected with reports of violence and prostitution. In the case of Metro Manila the people living in the gated community are taking distance from the poor people and the nationalism is disappearing. This results in a high stress between societies.

Similarities between the case studies Manila and Maldives

It is more challenging to detect similarities between the case study of the Maldives and the case study of metro Manila. However, important issues about food security discussed in the paper of the Maldives are also important for the gated communities in Manila. In the Maldives, the negative impacts of climate change on food security are changes in temperature, decrease in precipitation and a more frequent appearance of extreme events. These are problems that will continue to be present and therefore be even more damaging in the future. Food security and also the availability of potable water will become a worldwide problem, thus also in Manila. As explained above there is a clear separation between the wealthy and the poor in Manila city. Regarding the food- and water problem in the future, the stress between these societies will increase even more, because of uneven distribution and availability to these resources. Moreover, it demonstrates how the over consumption of the wealthy communities of Manila, translated in a social and economical division between them and the poor. This aspect can also be found in the Maldives. Furthermore, this over consumption is not only practice in Manila but all around the world, the first to be victim of the global changes is the flattest country in the world: The Maldives. This is a clear example of how the small scale system of the Maldives can act as a model or warning for another place in the world, in this case for Manila.

Overall similarities

The most important component that these case studies have in common is that the 'islands' are researched to improve the understanding of these developments on a larger scale. When facing the current and future environmental and socio-economic challenges, it is important to approach these studies in an interdisciplinary way. Both the biophysical as the social aspects are significant to understand the systems on 'island-scale', otherwise we could never understand world's complex systems.

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Disturbances on South Pacific Islands: vulnerability in isolation

A case study of Bougainville and Capricorn-Bunker Island group.



Figure 1. Location of Bougainville, the Capricorn-Bunker island group and New Zealand in the South Pacific (Google Maps, 2016).

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Abstract

This book chapter focuses on islands located in the South Pacific. The two islands and one island group are used as case studies: Bougainville, Capricorn-Bunker island group and New Zealand to study various topics. Although the studied islands and topics seem very different, we found similarities amongst these anomalies isolated in the Pacific Ocean.

In all three case studies our islands were used as laboratories. These islands were very suitable to use as laboratories because of their bounded size. The island boundaries also provided the island with isolation, which is a common characteristic amongst South Pacific islands.

We all found that the isolation on our islands was disturbed at some point and that the disturbance was often anthropogenic. Once the isolation on an island was disturbed its vulnerability and resilience was studied and discussed.

The book chapter is an interdisciplinary study on South Pacific islands with a great diversity of island case studies and topics, but with a general analysis of general island characteristics and processes.

Chapter introduction

This chapter starts with a case study on the island of Bougainville, located near Papua New Guinea. On Bougainville the Nagovisi tribe is studied, which is a matrilineal society, where women inherit through the female line and trace lineage through maternal ancestry. It is relevant to study this because broader lessons can be learned on modern day gender discourses. The relationship between the Nagovisi culture and the island characteristics of Bougainville are also relevant, due to the isolation, disturbances and the cultural resilience analyzed.

South-West from Bougainville we arrive at the Capricorn-Bunker island group, which is a group of coral cays on the South of the Great Barrier Reef off the East coast of Australia. The coral cays are mostly uninhabited and all have a unique ecosystem. This is again due to the island's isolation and although mostly uninhabited the isolated ecosystems were disturbed by humans. It is relevant to study the human disturbance to analyze the vulnerability of the Capricorn-Bunker biotas. This island group was also used to evaluate the effect of the human disturbance on the island biogeography theory developed by MacArthur and Wilson. Since this theory applies to islands in general, extensions to the theory derived from the Capricorn-Bunker island group are relevant for many other ecosystems around the world.

Southeast from the Capricorn-Bunker island group is New Zealand, which is the last island in this chapter. New Zealand is a country composed of two landmasses separated by the Cook Strait and several smaller islands. New Zealand was the longest isolated from human disturbances and that is why many of the native species are endemic. After humans broke the long isolation, invasive species were introduced. Many of the native species were not prepared for the new pressures and a lot of them went extinct. The situation was unsustainable and it was necessary for the government and inhabitants to take action. That is why it is relevant to study the way the New Zealanders came up with solutions to conserve the disturbed populations on their islands. All of the lessons from our three different areas can be incorporated into problem solving methods for creating a more sustainable earth. As we combine their lessons, we can learn broader lessons from this interdisciplinary approach. Thus, these lessons can be applied anywhere else on earth.

Island: Bougainville, Papua New Guinea
Topic: Matriarchy
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Amount of words: 3,941

Bougainville's Spectrum of Gendered Living

Introduction and Relevance

The Island of Bougainville, shown in Figure 1, is the largest island of the Autonomous Region of Bougainville, located near Papua New Guinea northeast of Australia. The island is approximately 9,318 km sq., about the size of Cyprus or Rhode Island, and is located between the Solomon Sea and the Pacific Ocean.

Among the family of Papuan languages is the Nagovisi language and people. This Bougainvilleas (although disputed as Bougainvillean, a majority of this paper's literature uses the former term) subculture lives in the South Bougainville District, which is the home to approximately 80,000 people. The Nagovisi are often characterized as a matrilineal society, one where women inherit through the female line and trace lineage through maternal ancestry.

The cultures of Bougainville have attracted interest for their deep connection with the earth that they live on. The people of the island of Bougainville, however, are not necessarily a united people. The various different subcultures and language schools of the island often engage in conflicts between themselves, and are separated by language barriers and land masses. The women of Nagovisi have been singled out time and time again as one culture in the world that is both matrilineal and run as a matriarchy.

The following paper will examine how the modern day gender discourses can be informed by one example of matriliney, the Nagovisi. In order to do so, we shall understand how their version of matrilinearity manifests itself, how concepts of female ownership have persevered over time despite the isolation and disruptions over the last two centuries. Lastly, we shall explore how the matrilineal customs of the Nagovisi differ from the other cultures on Bougainville and can provide lessons that can be applied to larger frameworks. Feminists recognize the story of Nagovisi society as a way to empower women and womanhood with the idea that the patriarchy and oppression by men can be paralleled with female ownership through matrilinearity. However, the way that the Nagovisi function in their society of matriarchy and matriliney, as well as their oppression through colonialism, tells a different story.



Figure 2. Map of Bougainville (Australian National University, 2012.)

The Fundamentals of Nagovisi Matriliny

The matrilineal process manifests itself in various ways, from religion, to marriage, to politics, to food production. In Nagovisi culture, women are in charge of the land and the men obey that ownership. The men must also agree to the arranged marriages, that of which the matriarchs set up. When focusing on this female path, the land is inherited from female to female. This results in women being relied upon to maintain a historical record of their family and clan. In this way, the “usage rights are accorded by sex: married men do not use land belonging to their own clans but into which they have been married” (Nash, 1978: 119). This conceptualization of land rights based on the sexes clarifies many issues for the Nagovisi decision makers as “(G)ender provides an obvious basis for such differentiation. The material effects of an arrangement of this sort will be to ensure unambiguous identification of owners in any community. The rights of those owners would thus be protected, and the opportunities for infringement of those rights by non owners would be minimized without compromising the scope owners have for expression of generosity through invitations extended to particular individuals” (Strathern, 1979: 972). Thus, within the Nagovisi, there are two different social groups which are further divided into clans of families, organized by the matriarch of the family. Each clan involves the matriarch and her extended family, except for the men who have moved away when they have married. The clans themselves make up lineages, organized and historically recorded by the mothers of the group.

The basis of the development of the matrilineal society of the Nagovisi are their traditional belief systems. “There is a saying in Bougainville that, ‘women are mothers of the land’. With this comes other key responsibilities such as keeping the family wealth and recording the family history.” (Gorasu, 2002: 27). This provides insight into the mother-nature philosophy on Bougainville: the reliance on women comes from their inherent nature of being birth-givers and food providers to the children through breast feeding, unlike their male counterparts. For many people on the island of South Bougainville, the island’s ground was worked as their deepest treasure. The ground was sacred because it carried and provided food. In the Western world, males are traditionally equated with the mind, while women have been equated with the body, such as in the teachings of Descartes (1984) and Foucault (1976) on sexuality. Male stereotypes imply that their decision-making skills are more important, while females are implied to nurture and care through the use of their bodies. The Nagovisi traditional beliefs follow this logic that women are important representations of body, and need to be protected as they nurture the world by bringing new children and maintain the family. This has been manifested in the Nagovisi ordainment of women as owners of the garden.

Men do have restricted rights in Nagovisi society. Within the restriction to gardening, they are alienated from ownership from their native clan. Marriage gives men permission to garden once again and thus there is somewhat of a transaction between intermarrying clans” (Dwyer & Minnegal, M., 1999: 378). Men have to move from their own village in order to maintain usage rights through the act of marriage. Often this act is not seen as a hardship because the clans intermarry between genetic relatives. These marriages are so common that, “Almost every marriage is between at least classificatory cross-cousins, and we have the impression, though based on an inadequate sample, that mating between actual cross-cousins related within four generations is much more frequent” (Oliver & Howells, 1957:956). Despite the oddities in paying for a marriage, the Nagovisi had an 80% satisfactory rate with fruitful marriages between 1888 and 1919 (Cultural Elements in Variation), before the disruptions to the culture in modern times (discussed below).

Land ownership, nonetheless, connects both the men and women to their life together. "Gardening with one's spouse is part of the definition of marriage, and neither men nor women have a gardens nor raise any significant amount of food until they are married. It would be considered highly improper for a man to share cultivation work on a regular basis with his sisters, his daughters, his mother, his wife's sisters, or his mother-in-law" (Nash, 1978:107). Women themselves dominate food production, and are in charge of all of the gardens that produce the food. As the leaders of the clans, these women decide when to have festivities, and typically base them around food.

Their traditional activities surround feasts, another moment where women are at the center of their community in Nagovisi culture. "To Nagovisi, a good marriage means to garden industriously, raise many pigs, and give big feasts. Because marriage is a relatively flux institution, the signs of marriage are that the couple sleeps in the same house, the couple walks around together, and the man works in the woman's garden" (Shams, n.d.). The feasts that result from the food cultivation are solely female driven. The women decide when a life event is worthy of celebration. These feasts and ceremonies that are held are in honor of the women, celebrating the first stream walk, the first pork feast and the first menstruation, something that is clearly gendered (Nash, 1978:107).

However much approval of female empowerment, any cultural hierarchies of gender, sexuality, socio-economic status or race are problematic. When we intersect any of these modes of hierarchy, it is often irrelevant in this context, unlike in Western culture where intersectionality is particularly important in discourses on minorities and women. One problematic parallel with the patriarchy is the use of groom price in Nagovisi marriages. Jill Nash has provided a detailed analysis of groom price, the mirror to brideprice, where the husband's family pays the wife's family for their daughter. These transactions only took place (in Nash's research) between high status families, highlighting further inequalities between class and gender. Groom price differs from dowries in that the "payments were made between the relatives of those to be married, rather than directly involving either the bride or groom; the payment consisted of movable property; and the payment was returnable in the event the marriage failed" (Jill Nash, 1978, 106). The use of groom price establishes that the objectification of men is present in Nagovisi society, just as female objectification is present in patriarchal societies.

A Brief History of Perseverance

The influx of Christian missionaries before World War I and during the 1930s provided a contrast with the traditional spiritual beliefs of the island and their belief in the earth as the greatest creature of them all, the foundation for the female prowess within the society. Most of the missionaries that came adhered to the teachings of Roman Catholicism, though some were Seventh Day Adventists (Nash, 1978: 120). The idolization of a supreme being as God, quite often viewed as a male entity, along with his son Jesus Christ, are foundations of western civilization that have given power to male bodies. Up until the infiltration of Roman Catholicism touched the Nagovisi society, women were the main entity of all religious or spiritual practice "Probably in pre-contact times, such women [first-born, female leaders] had even greater powers, including the power of life or death over certain members of their descent groups" (Nash, 1978: 121).

Then, the discovery of the Nagovisi land's consumer benefits resulted in harsher pulls on their traditional belief systems, and thus their sense of female entitlement.

An enormous deposit of copper and gold was proven in the mountains north of Nagovisi, in the territory of the Nasioi people, at Panguna in the 1960s. Within a few years, Bougainville Copper established one of the world's largest open-cut copper mines,

displacing many Nasioi, destroying the second-largest river system on the island, and ultimately in the late 1980s (though in no simple manner) causing a bloody revolution and war of secession which left thousands of Bougainvilleans dead and the island's infrastructure and political organization in ruins (Mitchell, 2013).

This colonialist venture destroyed conceptualizations of the earth's sacredness and infiltrated the landmasses in which the Nagovisi reside. Since there was a cycle of land ownership between mothers to daughters and their clans, there seemed to be bountiful amounts of land for gardening before the Second World War (Nash, 1997: 120). However, this system created large inequalities after some time, and clearer and clearer hierarchies began to emerge. The western cultures that overtook the Nagovisi land for economic resources, labeled the women of Nagovisi as inefficient and in the Western eyes, not important or productive. When these patriarchal colonizers devalued the system that supports the female empowerment within the Nagovisi, they once again shocked the system that worked for hundreds of years.

Despite the hardships brought upon by outside entities to this island and their people, the female prowess did not completely disappear, but was more established as a hierarchal system. These differentiations between men and women materially allow for instances of discrimination and oppression of males and their property. We can draw a parallel with extreme patriarchal societies, and old world politics of women in the West, where marriage was the most powerful setting for status building within society.

The Island Disruptions and the Global Island

The celebration of the first menstruation is one of the biggest differences that reflect upon larger societal trends. The celebration of womanhood, and particularly female sexual maturity, has oftentimes been ignored and shamed in our western patriarchal societies. Western societies further celebrate male sexuality over female sexuality. This hierarchy is displayed in the stigmatization of female sexuality with the words "whore" and "slut", and the almost ritual-like celebration at the loss of male-virginity. When we look at western culture as a whole, female sexuality is undeniably conceptually perpetuated as a commodity. However, the Nagovisi are completely void of this commodification. The Nagovisi instead "consider sex equally pleasurable for men and women." (Shams). This change in mindset can be viewed as an example for other cultures trying to solve gender inequality in other nations, as a path to better sustainability.

There is more here, however, than a cautionary tale for planners...The strength of Nagovisi institutions lies in the way in which men's and women's contributions to the household and the lineage are structured. Notions of nurture and labor are significant (Strathern, M., 1979).

It is apparent that within the Nagovisi tribe, sex with other partners in marriage is not frowned upon completely, but understandable as after a while it is typical that one would tire of ones husband (Nash, 1981:126.) This eliminates the *slut* and *whore* stigmas (Pheterson, 1993:67) that continue to perpetuate the idea that women can be valued based on their sexual activity. The rest of the island has had the highest statistics of men raping females in the Pacific.

The most drastic extreme to the Nagovisi on Bougainville are the Buin society, which has "some polygynous marriages, and chiefs have slave-girls who serve as prostitutes during feasts." (Shams). Siuai men function most similar to the Nagovisi, differing only in that they do not have their own matrilineal

property. These differences between the three different societies may be explained by proximity. As shown in Figure 2., the Buin society resides in the southern tip of Rugara, and the Nagovisi and Siuai are both extremely isolated by the vast rainforests on the island. As they live in the most densely forested area on the island, the Nagovisi, as an island subculture, has been given special self-development opportunities in their isolation.

Many patriarchal bodies are successful because, as Descartes (1984) established in his sixth meditation on the separation between the body and mind, men are equated and associated with the mind. Men in patriarchal societies have established a culture of war and thus consumerism to drive those wars. Women in the Nagovisi established a culture of growth and prosperity through a gardening culture that lived on the balance between people and their resources. The Nagovisi is far less of a war-making society than the Buin and the Siuai. These ineptitudes represent a converse to the parallels that the society portrays when compared with patriarchal systems, and one that is for the better.

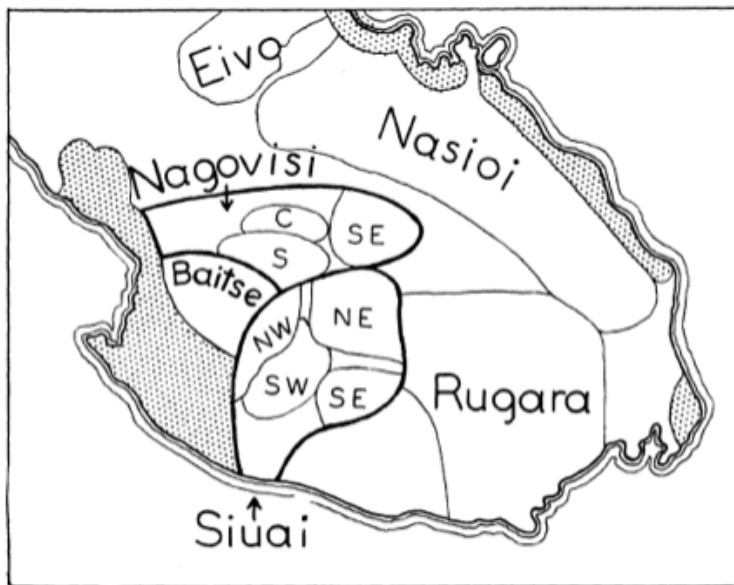


Figure 3. Map of the southern half of Bougainville (Oliver, D. L., & Howells, W. W., 1957:967).

Between the 1970s to the 1990s, there was a large amount of conflict on the island of Bougainville. The different gender norms between the societies had to find ways to coexist, though it does not appear that they have. Women are still raped, and women are still in charge of the Nagovisi society. This, more than anything, provides evidence that even within small pressure cookers of conflict that there are islands of people within islands themselves, which is provided by the islands natural boundaries. The land will provide a boundary and resolution because the Nagovisi

(P)rovided clearer boundaries to distinguish themselves from other Bougainvilleas'. There was consciousness of cultural differences with neighboring language and cultural groups but little of the full range of such groups within Bougainville let alone a consciousness of Bougainville as either a geographical or cultural entity. Bougainvilleas identity emerged in the context of Bougainville's recent integration into a world beyond the narrow limits of the pre-colonial political and economic situation.(Regan, 1998: 273).

The cultural differences among them did not stop the island from existing, as per the perspective of the Nagovisi. This is where the matriarchy differs from the patriarchy: there is no point to the Nagovisi in trying to get other societies to conglomerate with their ideological method and system, the mode of matrilinearity. This is simply because their ideological method of matrilinearity and matriarchy entitles them to be self-sufficient within themselves.

Infiltrations and contact with island-external societies have degraded the female power within the Nagovisi. This system of inheritance and government is a rarity amongst the world's societies as a whole, and is a particular rarity on the island of Bougainville. Although the Nagovisi have almost no instances of rape, the United Nations multi-nation study on Men and Violence in Asia and the Pacific, "Why Do Some Men Use Violence Against Women and How Can We Prevent It?" the island of Bougainville as a whole is ranked the highest on the number of men who "reported perpetrating some form of rape against a woman or girl in their lifetime." This translates to 62% of the men, with non-partner rape being more common on this island than in any of the other sites that were investigated in Asia. However, the fact that the fellow male-driven societies on the island (such as the Buin) have never been able to destroy the matrilinearity of the Nagovisi proves that the insularity of the island and the society's separation from the rest of the world has provided a barrier to degradation of female empowerment. Though the data on successful marriages and the differences between the Siuai and Nagovisi are fairly outdated and lack of information from the past 30 years, the history of missionary activity provides information for the period of the late 1800s and early 1900s.

Although most islands are void of metals, the Nagovisi are fortunate enough to live upon land that is full of them. The trust in the island's ground has brought them some favorable results. However, terrible the colonialism and the overrunning of their land was, the systems had some positive effects on their incredible society; it put its gender norms into question. When colonialists destroyed the earth, conceptualizations of womanhood and power were that is deeply connected to the earth are also in some ways destroyed. Colonialism on the island created large inequalities after many Nagovisi became dependent on cash cropping. Cash cropping created a system based on land ownership, and reinforced a pecking order of land wealth. This was converse to the system that levels out inequalities based on need between the clans and lineages. Thus, a strain was put on the matrilineal way of life, that the women were not necessarily the best owners of the knowledge of garden maintenance, according to patriarchal infiltrators (Strathern, 1979:258). The age of colonialism helped to put the system into question and helped the society engage in some self-reflections on community and gender hierarchies.

Perhaps it is the island nature of the Nagovisi ineptitude for war-making that have made them able to coexist with such drastically different cultures. The culture provides us with a strong example of cultural cohesion that Palestine and Israel, Pakistan and India, or even the United States may take a hint from. "The difference between these three different groups has allowed them to actually work together to solve the conflict between 1988 and 1998 for peace and political unity for their own (Kirch, 1997:38). Though the Nagovisi are generally not very inclined to modernizing (Strathern, 1979:261), they have found ways to make government work with fellow land mates on such a small area of land. In the lecture by Kenneth Rijdsdijk, he spoke about the inherent islandness of our planet Earth. If we use the Nagovisi's seeming ability to cooperate and persevere despite outside influences, we are able to see an example of our ability to share our resources while being able to hold on to what is truly important to us: our leaders and our traditions.

Within one island, one society has found a way to reduce the stigma surrounding the generalizations made about both islands and women. Although the group struggles with the duality of past and future,

with maintaining its roots and moving towards transformation, it has nonetheless rebranded the idea that small islands are inherently weak (Peterson, 2015). The Nagovisi women have proven that their strength in ownership over their lands is fundamental to their livelihoods as islanders. These dualities of island hood are present on the global scale, although perhaps, less obvious, we too as a grander society hope to move from our past and transform into the future at the same time. We can view the Nagovisi as another example of a success story in maintaining equilibrium between global and local in their isolated society.

Conclusion

Modern day gender discourses are constantly being molded by the new anomalies of gendered interactions. The Nagovisi matrilinearity informs our gender discourses as they provide a discord to common day discussions on the patriarchy. Their matrilinearity manifests itself in ways that both benefit gender relations as well as harm male members of their culture by systematically disadvantaging them. Nonetheless, the Nagovisi culture has persevered over hundreds of years of time due to their isolation as an island society within an island, despite disruption after disruption. The Nagovisi can color our worldview on gender and provide us with answers on how to move forward.

The Nagovisi tribe is not a perfect example of a matrilineal society. The culture is most certainly full of inequalities that are in some ways similar to those of the patriarchy that Westerners live with. The systems of patriarchy and matriarchy both limit the flexibility of men and women, and ignore those who lie outside the gender binary. Though their matrilineal system has been greatly reduced since the society has begun to interact with the outside world, it perhaps has changed for the better. The Nagovisi have been able to maintain their traditions due to their island home, with the protection of the rainforests that isolate their society. The concept of matrilineity seems particularly "old world" to some. This is perhaps because the dichotomy of matriarchal/patriarchal is harmful to both men and women and those in between.

It may seem as if the Nagovisi ignore the world dominance of the patriarchy as a whole. To others it may seem as if they have ignored the western development of feminism. Feminism in its current form is a simple will and push for equality, where women do not dominate over men, but where there is equality between the two sexes. The Nagovisi certainly lacks equal treatment between female and males. Instead the society opts for a hierarchy of female over male. But the isolation that the Nagovisi has experienced has allowed for a uniqueness that provides the world with an example of how to make things better.

Perhaps, in the idealist mindset that may make the world a better place, a reflection on the cohabitation that exists on the island of Bougainville may result in a better understanding of how the human race itself can get better. While the Nagovisi have rejected colonial powers' influence over consumerism, and thus avoided immense expenditures of the Earth's resources, we see the power in changing gendered orientations, even slightly, which may make the world more whole (Rijsdijk, 2015). As an island, the Nagovisi "islandness" is their foundation, in that the ground that they walk on has provided them with the strongest of tools, and provided the basis for their women to take the role that they have. "Uniquely microcosmic aspect of islands. Little worlds unto themselves, circumscribed and frequently isolated, islands are natural history's best shot at something approaching the controlled experiment" (Kirch, 2010). From this example, we can note a model of living based on different gendered ideologies, allowing us to take what works for the Nagovisi, such as their ineptitude with war and their embrace of female sexuality, in order to make change on our own continental islands.

Name of Island: Capricorn-Bunker island groups

Topic: The effect of human disturbance on classical island biogeography theory by studying arthropods and plants on the Capricornia Cays.

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The effect of human disturbance on classical island biogeography theory by studying arthropods and plants on the Capricornia Cays

Introduction and relevance

The Capricorn-Bunker island group consists of several coral cays distributed astride the Tropic of Capricorn also known as the Capricornia Cays. The islands are situated approximately 80 km east from Gladstone on the Queensland coast of Australia. The coral cays make up the southern end of the Great Barrier Reef Province. (Jell & Flood, 1978)

The Capricorn island group consists of nine coral cays and several reef structures. The coral cays are: North Reef, Tryon, North West, Wilson, Wreck, Masthead, Erskine, Heron and One Tree island. The Bunker island group consists of six coral cays and a reef. The coral cays are: Lady Musgrave, Fairfax (East & West), Hoskyn (East & West) and Lady Elliot Island. (Jell & Flood, 1978)

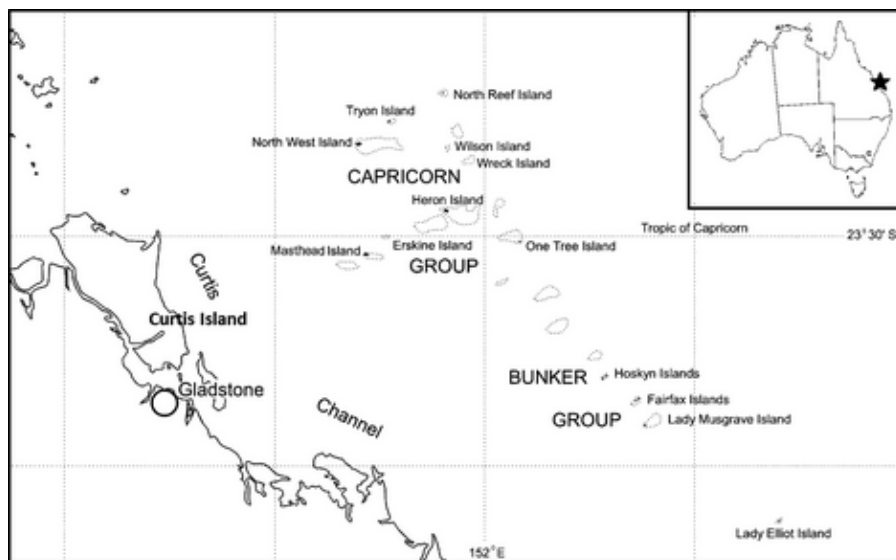


Figure 4. Location of the coral cays of the Capricorn-Bunker island group (Nakamura *et al.*, 2015).

The establishment of biota on an island can be studied with the equilibrium theory of island biogeography first published by MacArthur and Wilson in 1963. Edward O. Wilson was first inspired by his fieldwork on ants in 1954 and later tested his theory with arthropods in 1968 (Wilson, 2009). So it seems that arthropods are suitable model organisms to research the island biogeography theory more profound.

The most simplified form of the theory states that the rate of immigration decreases monotonically, while the rate of extinction increases monotonically, with increasing number of species on an island. And that the turnover rate and species richness is at an equilibrium where immigration and extinction rate are equal (see Figure 5). (Lomolino *et al.*, 2009)

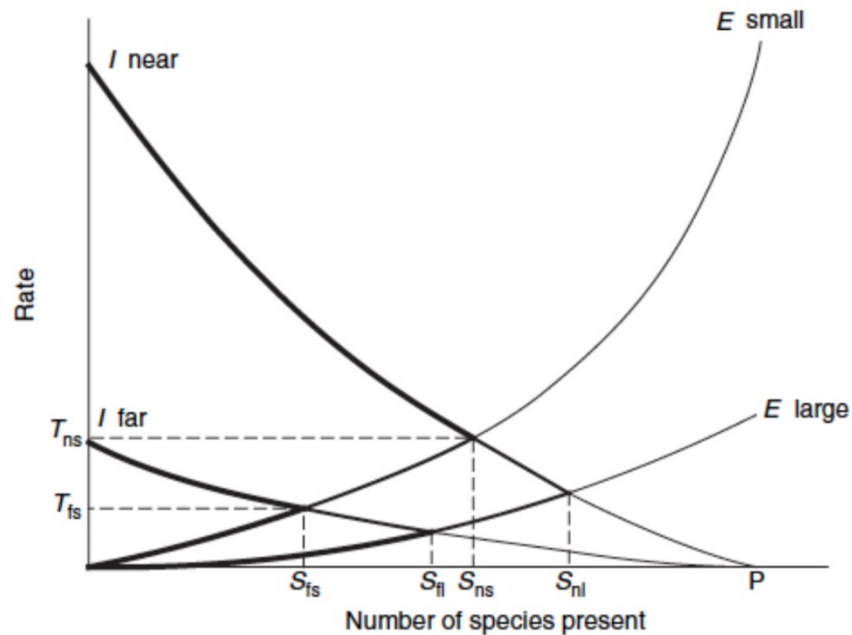


Figure 5. The relationship between the immigration (I) and extinction (E) rate (y-axis) on the number of species present (x-axis) on an island. The equilibrium (S) of the number of species present and turnover rate (T) is affected by the island area and isolation. An island can either be small (s) or large (l) and can either be near (n) or far (f) from other islands or the main land. The maximum number of species (P) that can inhabit an island is reached when immigration has stopped and extinction is at its maximum (Fernández-Palacios, 2015)

Since its publication it is argued that the equilibrium theory is an oversimplification of the complex dynamics of biological communities on islands. MacArthur and Wilson looked at the effect of island area and isolation but human disturbance is said to influence the equilibrium of the model as well. (Helmus *et al.*, 2014)

MacArthur and Wilson assumed that islands near to the main land would have a higher immigration rate than more isolated island further from the main land. It is easy to imagine that near islands are easier to reach for immigrating species. This was called the distance effect, which implied that near islands are inhabited by more species than far islands at an equilibrium. (MacArthur & Wilson, 1963)

Brown and Kodric-Brown (1977) proposed the rescue effect to explain the distance effect, which implied that species living on near islands would have a lower extinction rate because these populations have a higher probability to be rescued from extinction by remigration of individuals from the main land population.

Secondly MacArthur and Wilson assumed that small islands would have a higher extinction rate than large islands, because small islands are inhabited by smaller populations of a species. The limited resources and habitats on a smaller island could explain the smaller population. So the probability of extinction is higher for a smaller population of that species. This was called the area effect, which implied that large islands are inhabited by more species than small islands at a species richness equilibrium. (MacArthur & Wilson, 1963)

Other effects to explain the area effect were proposed. Such as the target effect, which implied that larger islands with a larger shore line had a higher immigration rate, because immigrating species had a

greater probability of being intercepted during their over water dispersal. When Buckley and Knedlhans (1986) studied the diversity of seaborne plant propagules and found that their species diversity was linearly related with shoreline length, on Australian islands.

It is important to realize that for an equilibrium model like MacArthur and Wilson's in situ speciation is not included, because the model assumes that the maximum number of species that can inhabit an island is the number of species that is available for immigration from the main land (see Figure 1) (Schoener, 2009). The Capricorn-Bunker coral cays are relatively recently formed only approximately 4000 year ago (Fairbridge, 1950). That makes the coral cays suitable to study the equilibrium model, because these islands still lack endemic species and did not undergo in situ speciation.

It is relevant to study the factors influencing the biota on the coral cays of the Capricorn-Bunker group, because they could give an insight into future biodiversity of the islands. And these factors could be fundamental extensions to the classical equilibrium theory of island biogeography of MacArthur & Wilson.

So the questions this paper is focussing on are: What is the effect of human disturbance on species richness on coral cays of the Capricorn-Bunker island group? And could human disturbance also influence the equilibria of MacArthur & Wilson's theory of island biogeography?

Analysis of island and topic

The coral cays of the Capricorn-Bunker island group differ from ordinary continental islands by their formation and their biota establishment. Continental islands on the Great Barrier Reef were attached to the Australian main land but separated by subsidence of the continental shelf and/or sea level rise. The biota of continental islands may originate from main land species that stayed on the island while it separated from the mainland and/or overwater immigration. (Heatwole, H., 1991)

Coral cays are formed from biological materials of the coral reef surrounding them, which are heaped up by waves, without a disconnected main land species community. The substrates on the coral cays consisted of sand, shingle or a mixture of both substrates (Batianoff *et al.*, 2012).

The coral cays of the Capricorn-Bunker island group have never been connected to the main land, so their biota originates exclusively from overwater immigration and later on anthropogenic introduction of exotic species. (Heatwole, H., 1991)

This biota originates logically from the Australian main land and Indo-Pacific islands, which makes it a special biota because it forms an insular biological community of an insular community (Batianoff *et al.*, 2012). This suggests that this biota is an example of a simplified version of a complex and dynamic composed biota and it eases the distinguishing between native and exotic species.

The vegetation types of the coral cays was best summarized and described as follows: "Vegetation of the islands generally consists of *Pisonia grandis* closed-forest in the interior with *Casuarina equisetifolia* open-forest and mixed shrubland of *Argusia argentea*, *Pandanus tectorius* and *Scaevola taccada* around circumference." (Nakamura *et al.*, 2015).

The coral cays of the Capricorn-Bunker island group vary in area and distance to the Australian main land (see Table 1). To estimate the place of the coral cays on MacArthur and Wilson's graph of island biogeography equilibria relatively to each other, the median distance and area of the island samples were calculated and categorized: far or near and small or large. So far islands are located further than 59 kilometers off the coast of Queensland, while near islands are located 59 or less kilometers off the coast. Comparably are large islands larger than 94.770 hectares, while small island are 94.770 hectares or smaller.

Subsequently can the equilibria of species richness of North Reef, One Tree and Wilson Island be placed around the S_{fs} -equilibrium in Figure 5. Wreck, Tryon and Heron Island's equilibria can be placed around the S_{fl} -equilibrium Figure 5. Hoskyn East, Erskine, Fairfax West and Hoskyn West Island's equilibria can be placed around the S_{ns} -equilibrium in Figure 5. And Lady Musgrave, Masthead and North West Island's equilibria can be placed around the S_{nl} -equilibrium in Figure 5. There was no data available from Fairfax East Island, but since it is similar in area and distance to Fairfax West Island, it is estimated that its equilibrium would also be around the S_{ns} -equilibrium Figure 5.

Table 1. The area in hectare and the distance to the Australian mainland in kilometers of the coral cays of the Capricorn-Bunker island group are shown. The table was based on information from datasets from Nakamura *et al.* (2015).

Island	Area (ha)	Distance to mainland (km)
North Reef	34.502	76
One Tree	55.463	66
Wilson	77.760	72
Wreck	100.841	76
Tryon	152.574	62
Heron	220.705	65
Hoskyn East	23.475	58
Erskine	50.181	54
Fairfax West	73.272	59
Hoskyn West	94.770	57
Lady Musgrave	194.906	59
Masthead	442.464	48
North West	1.198.463	57
median	94.770	59

The Capricornia Cays also vary in the amount and type of human disturbance that has taken place on them. Little is known about disturbance of Aboriginals prior to the disturbance of Europeans (Batianoff *et al.*, 2012). However no disturbance of Aboriginal use is likely to affect the current biotas on the coral cays. The human disturbance started in the 18th century due to European settlement. The coral cays are reserves that are partly or fully protected by the Capricornia Cays National Park of the Queensland government. Batianoff *et al.* (2012) summarized the historic and current human disturbances on the Capricornia Cays (see Table 2).

Table 2. Historic and current human disturbances on the Capricornia Cays. The table was based on information from Batianoff *et al.* (2012).

Island(s)	Historic disturbances	Current disturbances
Erskine	Low visitation.	Low visitation.
Hoskyn	Guano mining.	Low visitation.
Wreck	Low visitation; oil exploration; one private residence in late 1960s; turtle monitoring; introduced rats.	Low visitation, permitted visitors mostly consist of Capricornia Cays National Park staff.
Masthead	Campsite	Seasonal campsite without permanent buildings, capacity of 50 persons.

North Reef	Lighthouse/weather station, permanently manned until 1978, with planted gardens; introduced cats.	Low visitation, maintenance of automated weather station and lighthouse.
One Tree	Australian Museum leased reef in 1969, began building research station in 1971.	Sydney University research station.
Tryon	Campsite until 1990; guano mining from 1898 - 1900.	Rehabilitation following <i>Pisonia grandis</i> deforestation during late 1990s; volunteer weeding programs; revegetation trials.
Fairfax	Guano / rock phosphate mining; bombing range of Australian Navy; introduced goats, rats.	Low visitation.
North West	Guano / rock phosphate mining from 1891-1900; turtle-soup canning factory around 1910 and 1924; introduced cats, rats, mice and some plants and insects.	Seasonal campsite; 3 toilet blocks.
Wilson	Moderate visitation; campsite.	Resort; <i>Pisonia grandis</i> infection by scale insects in 2006 and 2007, biological control program using natural predator insects.
Heron	High visitation; Resort; University of Queensland's research station.	High visitation; Resort; University of Queensland's research station.
Lady Musgrave	High visitation; guano / rock phosphate mining; campsite; resort during 1930s.	High visitation; seasonal campsite; 1 toilet block.
Lady Elliot	Lighthouse; guano / rock phosphate mining, >90% of top soil removed, active replanting in 1960s.	High visitation; lighthouse; resort buildings, air strip.

Batianoff *et al.* (2012) then estimated the relative human disturbance of each coral cay and compared this to the percentage of exotic plant species on that coral cay (see Figure 6). The figure suggests a correlation between the amount of human impact on an island and the number of introduced exotic plant species present in its vegetation.

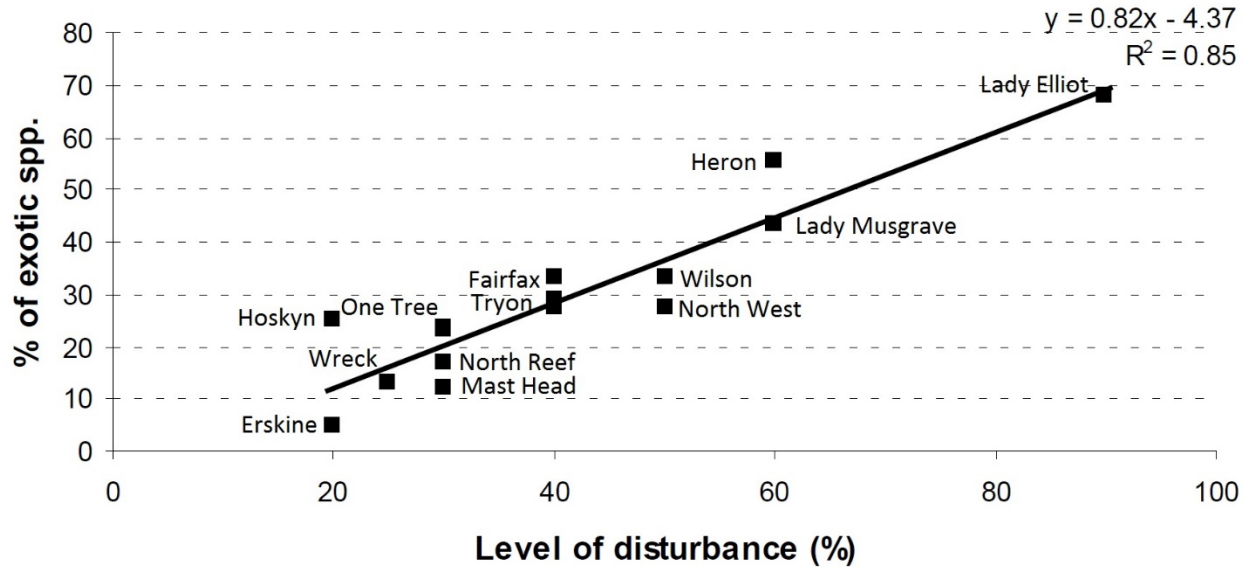


Figure 6. The relationship between the level of human disturbance and the percentage of exotic plant species with a coefficient of determination (R^2) of 0.85. Derived from Batianoff et al. (2012).

One example of an effect human disturbance had on some islands is the establishment of populations of exotic plants, which were brought to an island by humans. Batianoff *et al.* (2012) surveyed the vegetation of the Capricornia Cays and found 43 native plant species compared to 88 exotic plant species. They defined exotic plants as plants exotic to the Australian main land and plants brought to the island by humans, which formed a population on a Capricornia Cay.

Nakamura *et al.* (2015) found that the effect of human disturbance in the form of resort establishment was correlated with exotic plant species richness, while the classical effects of island size and isolation were neglected. This correlation was not species neutral, since native plant species communities are affected by island size and distance to the main land.

Batianoff et al. (2009) found that native plant species richness was not decreased by exotic plant species. Even the resistance of native plant species to exotic plant species is not species neutral and effected by human disturbance. Because the ecological traits of *Pisonia* closed forest blocks most sunlight before reaching the ground, exotic plant species cannot easily invade this native plant community. In other native plant communities human disturbance in the form of active weed management prevents invasion of exotic plant species. (Nakamura et al., 2015)

Another example of an effect human disturbance had on some islands of the Capricorn-Bunker group is the outbreak of scale insects. These outbreaks are often associated with a high abundance of the human introduced African big-headed ant (*Pheidole megacephala*). The dispersal methods of this ant are still unclear, but the incidence and abundance of the African big-headed ant is positively related to islands with a high level of visitation and human disturbance. (Burwell *et al.*, 2012)

New *P. megacephala* colonies are formed by budding; this is a process where by an ant queen leaves the old colony with a few worker ants to start a new colony. The dispersal of these ants over water seems unlikely. The propagule pressure, which is the frequency by which the queens reach an island, is better explained by the frequency of human visitations than over water dispersal on the Capricornia Cays. (Burwell *et al.*, 2012)

Pulvinaria urbicola is the most abundance pest scale insect on the Capricornia Cays, which infests the *Pisonia grandis*, which is a specialist tree species on coral cays and indigenous to the Indo-Pacific islands. 80% of the remaining *Pisonia* forest can be found on the Capricornia Cays. It is unclear what initiates

the outbreaks, but Nakamura *et al.* (2015) collected thousands of arthropods from the Capricorn-Bunker coral cays and found that *P. megacephala* was the most abundant arthropod species.

The impact of human disturbance is not species neutral, the significance of the effect differs among species. They found a negative relationship between *P. megacephala* abundance and native ant species richness and the effects of island size and isolation were neglected. Burwell *et al.* (2012) found that the invasion of *P. megacephala* native ant species richness decreased as a consequence thereof. Beetles and flies communities are influenced by classical effects as well as effects of the invasive ant species. While spider and cockroach communities were not affected by the invasive species.

Cockroach communities however were mostly affected by human disturbance in the form of frequent human visitation instead of classical effects. Exotic cockroach species richness was higher on frequently visited islands. (Nakamura *et al.*, 2015)

Even human disturbance in the form of community ecology research can affect species richness. An example thereof is the fieldwork Heatwole *et al.* (1981) did on One Tree Island when “one evening five moths flew into a researcher’s lamp, thereby reducing the adult population of that species by 2.5%.” (Morris, 1983)

Conclusion

The case study on the factors influencing the species richness on the coral cays of the Capricorn-Bunker island group could give more insight into anthropogenic effects. For example: frequent human visitation, resort establishment, active weed management and even research can have a greater impact, both positively and negatively, on species richness than island size and/or isolation.

Nakamura *et al.* (2015) concluded that the effects of human disturbance and adjacent effects of invasive species can be more significant in shaping a biological community on a small coral cay than the classical distance and area effects. Because the anthropogenic effects are stronger correlated with the species richness of several arthropods and exotic plant species.

The biological communities on the coral cays of the Capricorn-Bunker island group are influenced by a lot of factors. These factors are associated with the classical island biogeography theory: island size and isolation. However other factors are not associated with the original theory: like human disturbance in the form of introduction of exotic ants or plant species. Human disturbance could thus be fundamental effect extending the island biogeography theory.

So human disturbance has an effect on the species richness of the coral cays of the Capricorn-Bunker island group in many ways. Like the introduction of exotic species on the coral cays due to high visitation of a coral cays or planted around a light house base or resort that disperse to form a wild population. Or the introduction of exotic ant species with the associated outbreaks of scale insects and the deforestation of native trees as a consequence. These are two examples of negative anthropogenic effects on the species richness. But humans also can have a positive influence on a coral cay biota. For example the active weed removal of exotic plant species by volunteers or a biological control program using natural predator insects for the eradication of scale insects.

Considering the effects human disturbance has on the species richness on the coral cays of the Capricorn-Bunker island group it would be likely that human disturbance also has an effect on the species richness equilibria estimated for the coral cays based on the classical theory of island biogeography of MacArthur and Wilson. However to conclude that human disturbance is an general

extension on the original theory more research has to be done on this phenomenon, because this case study only observed the effects on human disturbance on small coral cays. So to answer this last question more research has to be done on the effect of human disturbance on island biogeography theory equilibria on a great variety of islands.

Chapter discussion and conclusion regarding central topic

In this chapter we have done research on three islands that are unique and diverse. Moreover, we have exposed different points of views depending on the island; this helped us to analyze the different topics that involve them, an overall interdisciplinary view of the island's life.

This research was carried out on islands because they are perfect laboratories for different topics. They are surrounded by water and as a consequence they have unique geological, ecological and cultural histories due to their isolation. They are also characterized by low population density and scarcity of resources. However, another common characteristic between the islands is their vulnerability, in general an island is more exposed to the effects of climate change, such as the sea level rise, the pressures of the resources scarcity, growing population, etc. All these characteristics together make our islands natural laboratories.

In this chapter we have studied biophysical and socio-cultural processes and we have seen the responses of these islands to their problems and threats. However, we know that islands have unique characteristics, could we use them as models for the rest of the world? Could we learn something about these islands? Could we apply these lessons on a global scale?

It is difficult to identify which are the best and the worst practices used in these islands regarding their sustainability. It is necessary to take the history of the island into account and the current situation, as different practices can be better or worse depending on the individual island. For instance, in each of our islands we have seen different solutions to different problems.

In the first paper we have focused on the island of Bougainville, particularly in the Nagovisi society. We know that the situation of this island is maintained thanks to its insularity and which is different for the rest of the world. Regarding the research of this island we can learn methods of equality that can be relevant on a global scale. For feminists the Nagovisi society is a model to enhance woman and womanhood. This culture is also based on the balance between people and their resources. The characteristic of this society can be viewed as an example for other cultures trying to solve gender inequality, and as a way to become more sustainable.

In the second paper we did research on the Capricorn-Bunker island group, the biota of these islands is originated exclusively from overwater immigration and later anthropogenic introduction of exotic species. This suggests that this biota is an example of a simplified version of a complex and dynamic composed biota and it eases the distinguishing between native and exotic species. The lack of endemism makes these islands the perfect laboratory to study the factors that influenced their biota and thus allow us to have insight into future biodiversity of islands, specifically into anthropogenic effects.

Finally, in the third paper we have focused on New Zealand, which is characterized by its native biodiversity. These native species have been threatened over the years because of different pressures and some of them have gone extinct. However, thanks to the efforts in conservation biology of this island, the current situation has improved. The biodiversity is recovering and the island is following the correct way to be sustainable. New Zealand is a model for the rest of the world, as all the effort done in the conservation of its biodiversity can be studied and applied in other regions with threatened biodiversity worldwide, since it is an important issue that affects the entire globe.

The ecological problems in the South Pacific are exemplified in two of the papers from this chapter, and stand alone as insightful to the future of South Pacific Islands. However, combining the knowledge and

insights from all three articles, we can find ways to strategically reduce the amount of clashes in resolving issues that can help better plan for the future. The insights can thus be applied to the other regions of the world, and thus the globe. In doing so, we hope that we can take a more holistic approach to the worldwide analysis and problem solving - similar to that of holistic medicine. Time and time again it has been proven that focusing on one aspect or one variable does not allow for complete healing. We live in a world that is utterly interdependent on itself.

The South Pacific in particular exemplifies the necessity of interdisciplinary problem solving. Although each area has its very specific culture as well as unnecessarily vulnerable biospheres, the need for problem solvers in the South Pacific are especially necessary. The region itself has long been fraught with immense colonization. Because it was one of the last places to be populated on earth, studies on these areas are likely less analyzed and taken into critical account, least of all taken into account holistically. More than that, the South Pacific is a wider representation of the Earth, as it hold so many variants within itself regarding to both the biological elements and the cultural atmospheres. The South Pacific, particularly Australasia, has a diversity of both animals and people that have a large range of characteristics. The South Pacific region shows many features of the diversity of earth itself.

Due to its parallels in diversity with its larger island sector, the Earth, the interdisciplinary problem solving within the South Pacific can be enlarged and applied to larger interdisciplinary sector, and necessary problem solving on the planet. Interdisciplinary problem solving itself is fundamental to a conscientious and meaningful understanding for implementation of new systems or for movements of change. Interdisciplinary approaches allow for a conscientiousness that decreases conflicts when problem solving.

If anything has been clarified within this chapter, it is that taking a non-intersectional approach to any example or analysis will result in a one-sided conclusion. For the Capricorn-Bunker island species, theories on such speciation have confined the topic too narrowly, while human disturbance and interspecific differences must be included. For the Nagovisi tribe, Lastly for the New Zealander's we can see the results of their interdisciplinary thinking, because they see the relationship between biodiversity, economy, tourism, productivity, as well as others. In many ways the Nagovisi parallel that of the species on the Capricorn-Bunker island group. They both have been considered narrowly in their analysis over time. The biota gives insight into future biodiversity while the Nagovisi provide insight into future gender relations and diversity. If we apply these large theories and application of intersectionality into the future, refusing to confine groups into narrow definitions and generalization, we can end up with more countries such as that of New Zealand, who has conscientiously spearheaded their future by taking in an interdisciplinary approach.

In conclusion, the islands studied in this book chapter can serve as models for similar situations in others parts of the world, but it would be necessary to analyze the conditions of the different places, as it could be errors in the models. In either case, these islands have allowed for learning many lessons regarding conservation biology, protecting ecosystems, improving equality, sustainability, resolving conflicts, and managing limited resources, etc.

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