Local Insights into Climate Change Adaptation in Cabo Verde

A study from rural agricultural areas of Santa Cruz on Santiago Island

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ABSTRACT

Impacts of climate change in Cabo Verde are felt by many, and adaptation to the changing climate is common. To grasp how climate change adaptation affects local people and environments, and if the adaptation could and should be improved, it is relevant to take a closer look at local's experiences of this. This study intends to find out if the current adaptation strategies in Santa Cruz in Cabo Verde are in line with local people's needs in terms of adaptation. The study asks: to what extent do locals perceive that the ongoing climate change adaptation process corresponds with their needs. It also puts a critical focus on adaptation by asking about positive and negative sides of it, about participation in the adaptation process, and about differences between groups and between people, including women and men. In this context, it is climate change adaptation in a rural agricultural setting that is being explored, largely water-related adaptation and agricultural adaptation.

Based on a literature review related to climate change, adaptation and gender, qualitative interviews and observations were conducted amongst people that worked or lived in rural agricultural areas of Santa Cruz. The findings revealed that adaptation has a high cost for local people, which they often have to bear themselves. There is still a need for more and different kinds of adaptation than the current adaptation strategies in Santa Cruz. But because many locals cannot afford the necessary adaptation themselves, there is a need for increased assistance from government and international institutions. Different groups have different possibilities to adapt to the changing climate. The study also found a gender difference in preferences and needs of adaptation, and in possibilities to secure a living. The analysis further shows that there is a need for governmental and international institutions to include local people in climate change adaptation. On this basis, the study recommends that the governmental and international institutions use local knowledge when deciding adaptation strategies for Santa Cruz in the future, and assist local people in adapting to a changing climate.

Keywords

Water, climate change, global warming, drip irrigation, knowledge, CO2, greenhouse gases, solar panels, adaptation, agriculture, water wells, dams, water reservoirs, plant diseases, soil, pesticides, fertilizers, gender, Santa Cruz, Santiago Island, Cabo Verde

Picture 0:1 Street art "MINÍNU" in Santiago, Cabo Verde by Daniel Eime (2018)

Photo (in black & white): Larsen, L. (2019)

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Lisa Katarina Larsen

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List of abbreviations

ADF – African Development Fund

AFDB – African Development Bank

CO2 – Carbon dioxide

FAO – Food and Agriculture Organization of the United Nations

GHG – Greenhouse gases

INE – Instituto Nacional de Estatística Cabo Verde

INPS – Instituto Nacional de Previdência Social Cabo Verde

IPCC – The Intergovernmental Panel on Climate Change

NAPA – National Adaptation Programme of Action

SDG – Sustainable Development Goals

SSM – Sustainable soil management

SWC – Soil and water conservation

UN – United Nations

UNDP – United Nations Development Program

UNEP – United Nations Environment Program

UNODC – United Nations Office on Drugs and Crime

UN Women – United Nations Entity for Gender Equality and the Empowerment of Women

USGS – United States Geological Survey

WHO – World Health Organisation

1. INTRODUCTION

Cabo Verde is a country that is highly vulnerable to climate change (UNDP, 2015; UNDP, 2018a). The rural agricultural areas in the country are especially vulnerable to climate change, because of the scarcity of water and rain (UNDP, 2015). There is usually a high level of poverty amongst the people living in these rural areas (Governo de Cabo Verde, 2018). This makes it vital to listen to the local's experiences with the adaptation processes related to climate change (Eriksen et al., 2015). It is important to see whether ongoing adaptation strategies are corresponding with local viewpoints of what is needed the most. Also, it is key to listen to both negative and positive sides that the locals experience due to adaptation where they work and live (Taylor, 2014). On this background, we will take a closer look at local viewpoints of climate change adaptation in the Santa Cruz municipality on Santiago Island in Cabo Verde. This with data collected by qualitative interviews and observations conducted amongst people that worked or lived in rural agricultural areas of Santa Cruz.

To listen to women and men, as well as different groups and people in the society in a democratic way is important to understand people's situation, and to be able to form policies that are positive for the rural society and the agricultural area (Eriksen et al. 2014; Cornwall, 2004). There may be differences in the way men and women perceive adaptation, and how they are affected by climate change impacts, so it is relevant to see gender differences in their viewpoints (Cornwall, 2003).

The purpose of this research is to put a critical focus on adaptation processes and describe local perceptions of climate change adaptation, especially if it corresponds with their needs, in rural agricultural areas of Santa Cruz in Cabo Verde.

1.1 Local perceptions of adaptation related to climate change

According to Eriksen et al. (2015, p. 528), it is a common problem in many regions in the world, that there are not many studies of climate change impacts locally, seen together with vulnerability and poverty. In these days adaptation to climate change is heavily encouraged (FAO, 2016a; FAO, 2018b), although little is known about how adaptation affects a local environment when seen by locals in both positive and negative ways.

The local experiences and viewpoints of adaptation in Santa Cruz give us insights into their agricultural work, and the consequences of adaptation because of climate change, which is highly valuable for further work within the field.

1.2 Climate Change – Causes

There is a scientific consensus among 97 percent or more of actively publishing climate scientists that the global warming of the past century is extremely likely caused by human activities (NASA, 2020a, para. 1).

Especially the burning of fossil fuel has caused the climate-warming (NASA, 2020b, para. 4). When fossil fuels like coal and oil are burned, the concentration of carbon dioxide (CO2) rises in the atmosphere, according to NASA. Also, the concentration of other greenhouse gases that increase the likelihood of global warming is caused by human activities, but to a lesser extent (NASA, 2020b, para. 4).

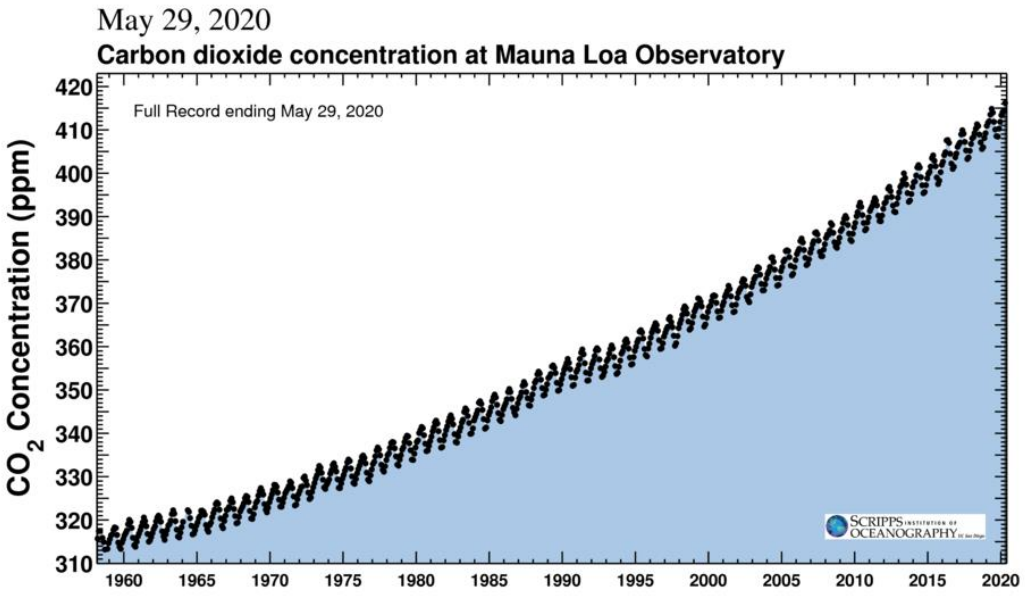


Figure 1:1 Concentration of CO2 from 1958-2020

(Scripps Institution of Oceanography, 2020)

As can be seen in the graph, the CO2 concentration in the atmosphere rises each year. The rise of CO2 these years occurs because of human activities leading to emission of CO2 into the atmosphere (Scripps, 2020; NASA 2020b).

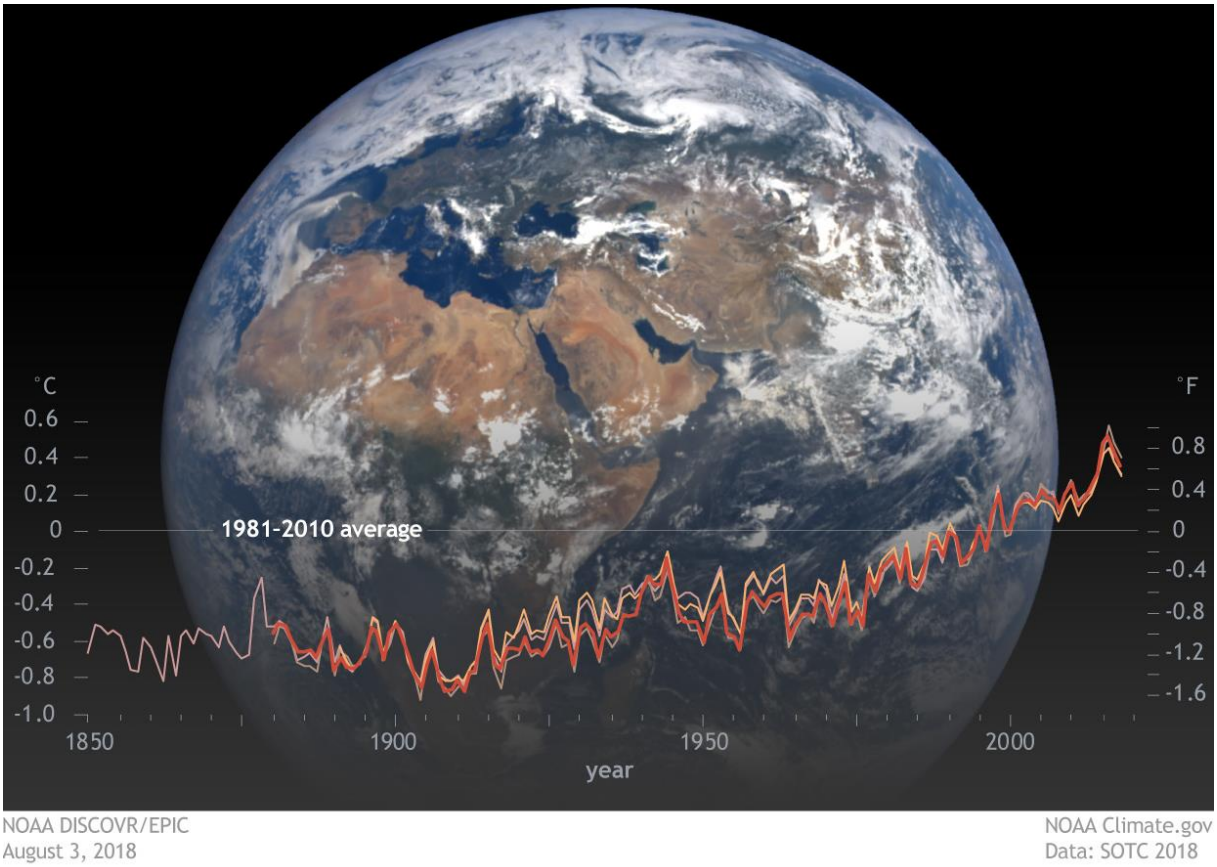


Figure 1:2 Surface temperature 1850-2018

"History of global temperature … compared to the 1981-2010 average from four analysis teams: NOAA (red), NASA (tan), University of East Anglia (pink), and the Japan Meteorological Agency (orange)."
(Lindsey & Dahlman, 2020)

At the Intergovernmental Panel on Climate Change, 1,300 scientific experts concluded that the likelihood of human activities in the last 50 years caused the warming of our planet is more than 95 percent (IPCC, 2014, p. v; NASA, 2020b, "The Role of Human Activity", para. 1).

> "According to the NOAA 2018 Global Climate Summary, the combined land and ocean temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880; however, the average rate of increase since 1981 (0.17°C / 0.31°F) is more than twice as great. … The 10 warmest years on record have all occurred since 1998, and 9 of the 10 have occurred since 2005."
>
> (Lindsey & Dahlman, 2020, "Change over time," para. 1-2)

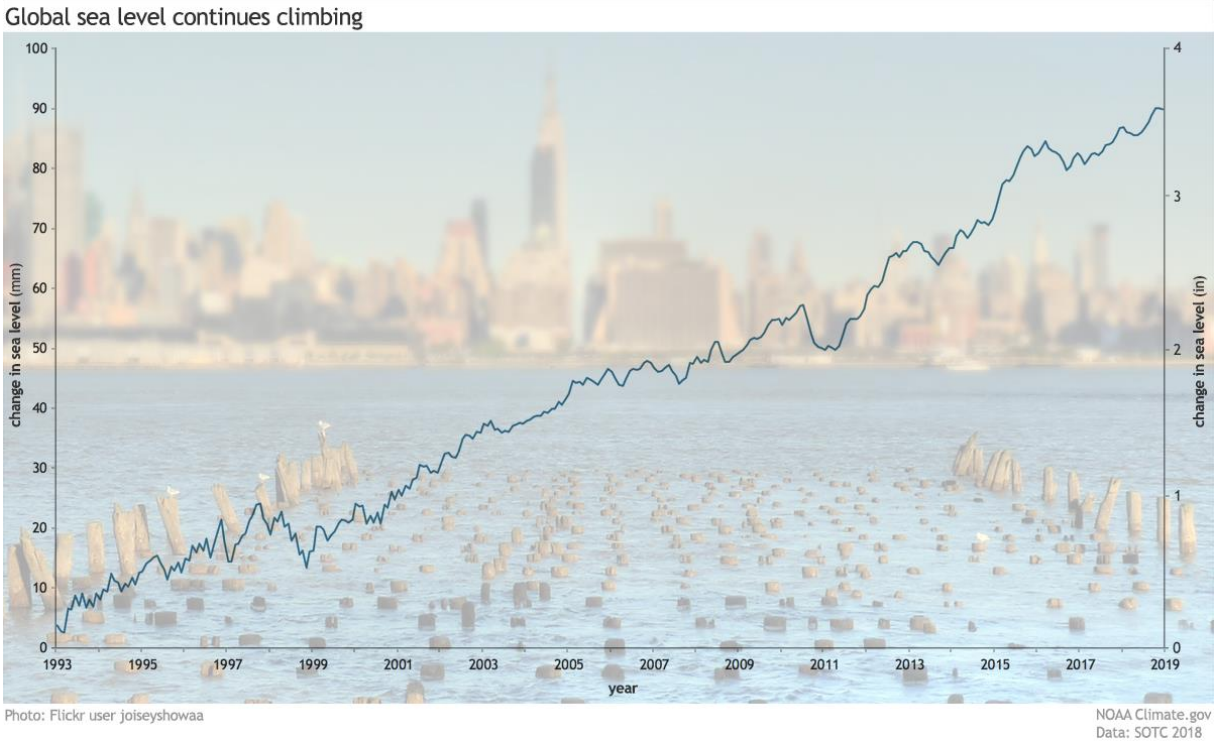


Figure 1:3 Global sea level 1993-2019

(NOAA, 2018)

According to NOAA (2018), the global sea level has risen to record high levels for seven years in a row. At average, the global sea level rises at a rate of 3,1 cm per decade (NOAA 2018).

1.3 Climate Change in Cabo Verde

Although the people in Cabo Verde have contributed very little to the emissions of greenhouse gases including CO2 and hence, global warming, they now suffer from the consequences of climate change (European Commission, 2016, pp. 2-3; UNEP, 2012).

According to the data source CAIT of the online platform Climate Watch (2020), the total emission per capita (including Land-Use Change and Forestry) was 0,7 CO2e in Cabo Verde in 2016. To compare that for example with Norway, we can see that the total emission per capita (including Land-Use Change and Forestry) is very much higher, with 13,78 CO2e in 2016 (Climate Watch, 2020).

As climate change contributes to the warming of sea and land, which leads to rising sea levels and more frequent droughts, food security and water supply in Cabo Verde are getting more and more difficult to manage (European Commission, 2016; McSweeney, New & Lizcano,

2012). This is happening although Cabo Verde has a "negligible" contribution to global warming, according to the European Commission (2016, p. 2).

Climate change is a considerable threat for Cabo Verde, as it has a vulnerable arid landscape located in the Sahel region, and also is one of the Small Island Developing States (SIDS) (UNEP, 2012). Climate change can affect critical areas such as water resources, food security and ecosystems (UNDP, 2015). Degradation of the coastal zones is also a concern (UNDP, 2018a), and sea-level rise can affect the people on the islands (UNEP, 2012; European Commission, 2016).

1.4 Climate Change and adaptation in Cabo Verde

Cabo Verde is one of the countries in the world that makes the largest advances in adaptation towards climate change, according to Notre Dame Global Adaptation Index (Sieff, 2017, para. 2). But despite adaptation and agricultural policies, the rural agricultural areas in Cabo Verde still suffer from poverty, and it is women who are amongst the poorest (Governo de Cabo Verde, 2018, p. 58). There are large inequalities between women and men in some of the rural agricultural areas, according to Marone (2016, p. 12).

Around 40,000 people have left agriculture, and most of them have moved to urban centres, often where there are tourist-industries (Governo de Cabo Verde, 2018, p. 42). Over 90 % of the cereals (like corn, wheat and rice) come from other countries (p. 40). About 30 % of this comes by food aid, and 70 % by commercial import, according to Governo de Cabo Verde (p. 40).

Taylor (2014, p. 50) tells that all of the major international development institutions focus on adaptation toward climate change.

In this research climate change adaptation in rural agricultural areas of Cabo Verde is being explored, largely water-related adaptation and agricultural adaptation.

1.5 A general historical overview of the Cabo Verde Island

The Cabo Verde islands got inhabited around 1460, first by European settlers, who started using them as a transit point for the Atlantic slave trade and also brought slaves from West Africa to

live on the islands (Batalha & Carling, 2008, p. 146). A Portuguese colony was created, which remained until independence was achieved by the Cabo Verdeans in 1975 (p. 14).

There has been an enormous change of the environment since Cabo Verde first was inhabited (Lindskog & Delaite, 1996, p. 285). Some of the first descriptions tell that the islands had a "dry but 'well-wooded' savanna with 'great quantities of grass' and 'streamlets of water'" (p. 271). This changed dramatically, towards "a near-deserted landscape, especially in the lower altitudes" (p. 271), and there is still a vast scarcity of natural resources in Cabo Verde (AFDB/ADF, 2012, p. 4), which is very visible today, for example in the islands of São Vincente, Sal and parts of Santo Antão.

Reforestation and restoration have been attempted since the 1920s (European Commission, 2016, p. 3), and forests have been planted on the islands of Santo Antão, Fogo and others (USGS, 2018). To increasingly stop the environmental degradation and accomplish soil and water conservation (SWC) works, however, Amilcar Cabral (1949-50) suggested that there was need for political will from the Cabo Verdeans themselves, and not from the Portuguese colonial power (as cited in Lindskog & Delaite, 1996, p. 285). Despite long claims for it from the people, SWC implementations were first started the last decade of the colonial rule (Lindskog & Delaite, 1996, p. 285). Since, there has been ongoing adaptation, including "enormous effort in the implementation of SWC and reforestation" (Baptista, 2013, "Introduction", para. 3), because of the environmental degradation, lack of water, and climatic changes (Haagsma, 1995; Baptista, 2013; UNDP, 2015).

1.6 Research statement

Cabo Verde has a long history of colonialization, land degradation, restoration and adaptation. The country is highly vulnerable to climate change. Does the local people's perception of climate change adaptation that is needed correspond with the ongoing adaptation process they experience?

1.7 Research questions

(1) To what extent do locals perceive that the ongoing climate change adaptation process corresponds with their perception of needed adaptation?

(2) What positive and/or negative sides of climate change adaptation do locals experience?

(3) What differences between groups/people regarding positive and/or negative sides of climate change adaptation do locals experience?

(4) To what extent do the locals feel that they are heard in a democratic way in the process of adapting to climate change?

(5) To what extent is there a difference between women's and men's perceptions regarding local climate change adaptation strategies?

1.8 The Cabo Verde Islands as geographical setting

Cabo Verde is an archipelago of ten islands. Nine of them are inhabited (Governo de Cabo Verde, 2018, p. 8). The islands are located 500 km west off the coast of West Africa and are divided in the Sotavento (leeward) and the Barlavento (windward) groups (Governo de Cabo Verde, 2018, p. 8; UNDP, 2018a). Cabo Verde's population was 537,661 per 2017 (Governo de Cabo Verde, 2018, p. 14).

Figure 1:4 Cabo Verde Islands including Santiago Island

(Google Earth, 2020)

Out of the total land in Cabo Verde, only 10 % is arable (Governo de Cabo Verde, 2018, p. 8). Approximately 82.5 % of the agricultural land is currently made use of according to Governo de Cabo Verde (2018, p. 41). As there is often very little rainfall in Cabo Verde, droughts and lack of water are common problems (European Commission, 2016; Haagsma, 1995; Corral, Díaz, Monagas & García, 2017; Baptista, 2013). Additionally, there are problems of poverty in the rural areas in Cabo Verde. Rural areas also have the largest gender gaps in the labour force, according to Marone (2016, p. 12).

With this background, it was chosen to conduct the study with locals working or living in the rural agricultural area of Santa Cruz in Santiago island.

1.9 Santa Cruz municipality on Santiago Island as research area

The research in this project is based on rural agricultural areas in Santa Cruz municipality on Santiago island in Cabo Verde. The municipality of Santa Cruz is located on the east side of Santiago island, with a population of 26,190 per 2017 (INE, 2018a). The respondents in this research were either living or performing work in the Santa Cruz municipality when the research was carried out.

Figure 1:5 Research areas in Santa Cruz, Santiago, Cabo Verde

(Google Earth, 2020)

Santa Cruz municipality was chosen for the research after receiving local advice about various locations in the Cabo Verde Islands and Santiago Island. It was told by locals that the rural

agricultural area with irrigated plantations in Rocha Lama would be a good location for questions of adaptation and it was also expressed that there were challenges that could be related to climate change. There were not known to have been any recent projects. The farmers had experienced a reduction of yields, for instance in reduced amounts of bananas, locals told me.

Fieldwork with qualitative interviews and observations were thereby first started in the Rocha Lama irrigated agricultural field and plantation (located latitude 15,125, longitude 23,540), with banana, coconut, manioc and papaya trees, sugar canes, as well as other fruit and vegetables like tomatoes, maize and pumpkin, and livestock farming. It is not known of any recent projects that have been carried out in Rocha Lama, but according to respondents and also observation, there was governmental assistance and/or an external company there fertilizing the soil around the plants of the plantation during the fieldwork. There is also a more general governmental project related to drip irrigation taking place.

To increase the number of female respondents, it was decided to expand the research to the nearby villages Achada Fazenda and Achada Colaço in Santa Cruz, where qualitative interviews were conducted (located latitude 15,117, longitude 23,519). For the same reason, fruit and vegetable sellers from Pedra Badejo (located latitude 15,136, longitude 23,533) in Santa Cruz, who were working at markets in the capital city of Cabo Verde, Praia, were included in the research. The women were very busy collecting fruits and vegetables by the plantation, and stayed for a short time at the agricultural fields in Santa Cruz, before they travelled to sell it at the markets, for example in Praia. The fruit and vegetable sellers, therefore, had more time to participate in interviews when they were at the markets.

Although Santa Cruz has large agricultural areas with irrigated plantations, it was the municipality with the highest incidence of poverty in Cabo Verde, with 58.9 % of the population living below the absolute poverty line per 2015, according to statistics by Instituto Nacional de Estatistica Cabo Verde (INE 2018b, pp. 60-61). Amongst the population in Santa Cruz, 27 % were living in extreme poverty, which was the third-highest incidence of extreme poverty amongst the counties in Cabo Verde per 2015 (p. 67).

When looking at extreme poverty and gender in Santa Cruz municipality per 2015, 56.6 % of the extremely poor were women, and 43.4 % were men according to the statistics by INE (2018b, p. 76). Amongst the poor population in Santa Cruz municipality 53.3 % were women and 46.7 % were men per 2015, according to INE (p. 76).

It should be noted that statistics do not include all aspects of society, such as informal work, and may have limitations in its accuracy (Charmes & Wieringa, 2003; Chant, 2006). Aspects such as informal economy, agricultural work, as well as domestic, reproductive and care work are not necessarily included in the measures, but also of relevance (Charmes & Wieringa, 2003). In the informal sector in Cabo Verde, 58.8 % of the workers were women, and 41.2 % of them were men in 2015 according to information from INE (2017, p. 53).

1.10 Thesis outline

This thesis consists of six chapters. The *first chapter* gives an introduction of the main purpose of the study, and the research statement and research questions are presented. Also, an overview of the Cabo Verde Islands and Santa Cruz municipality as the research areas is given. *Chapter two* consists of a literature review, that together with the theoretical framework and methodology in *chapter three,* form the basis of this thesis. *Chapter four* presents the empirical findings from interviews and observations in Santa Cruz in Cabo Verde. In *chapter five,* there is given an analysis of the findings, where the theoretical approach and secondary literature are seen in relation to the findings. In *chapter six,* concluding remarks are drawn, as well as possibilities for further studies are suggested.

2. LITERATURE

This chapter gives an overview of literature that is relevant in relation to climate change adaptation in Cabo Verde. The theoretical framework presented in chapter three builds on some of this secondary literature. Secondary literature is also being used throughout the thesis, especially to connect the findings to a broader context.

2.1 Environmental degradation – initial vulnerability, human behaviour, and climate change

Lindskog and Delaites (1996) article is about the history of Cabo Verde's environment and discusses how there may have been a combination of an initial vulnerability on the islands, of human behaviour after the first people started moving to the islands around 1460 (especially the impact of how the Portuguese colonists imported and kept goats on the islands) and climate change, that has led to the severe degradation on the islands.

Gianni, Biasutti & Verstraete (2008) focus more on the impact of climate change. Gianni et al. analyse the evidence that is connecting the droughts and desertification of the Sahel region with climate change. By looking at how advanced climate modelling, it shows that the warming of the oceans, and not circumstances on the land can be the reason for the continuing droughts the Sahel experienced in the 1970s and 1980s (Gianni et al., 2008, pp. 120-127). This explicit connection that exists between droughts and oceanic warming makes it relevant to reflect on whether anthropogenic impacts lead to persistent droughts as an early manifestation of climate change (Zhang et al., 2007 and Kerr, 2003 as cited in Gianni et al., 2008, p. 122). Simulation of the change in the Sahel with knowledge of only the sea surface temperature gives favour to the hypothesis that "[…] the origin of persistent drought in the Sahel is global in scale, and external to the region" (Gianni et al., 2008, p. 126). Some of the land changes seem to stem from ocean forced changes in precipitation and some changes have been affected by human activity locally (Gianni et al., 2008, p. 127).

2.2 Perceptions of the environment

Ingold (2000) recognises that the mind and the body are not separate and that the mind is shaped through a person's history and in relation with others. The way people think, perceive things, remember, and learn needs to be studied in an ecological context interrelated with the

environment, according to Ingold. He sees psychological processes and social processes as the same and reformed through "the enminded body" or "embodied mind" (Ingold, 2000). According to Ingold, environments are all the time "under construction". As long as humans stay ("dwell") in an environment, they will think about constructing or construct the environment (Ingold, 2000). There seem to be considerable differences regarding how humans in different societies perceive and relate to the environment, and to what extent humans "construct environments", Ingold tells. Variations in closeness to nature and different cultural beliefs, may result in different values towards nature. Eriksen et al. (2015, p. 528) point out that the knowledge about climate change has different values in different cultures, geographic locations, and analytical settings. Especially capitalist societies in the Global North and their enormous consumption is leading the circumstance that environments are constructed much more rapidly than before, maybe to the limit of what the earth can bear. Reflecting critically over this in the debate about climate change and adaptation, as Taylor (2014) argues, seems of great importance.

2.3 Adaptation, control, and power

Taylor (2014, p. 189) is criticizing how adaptation to climate change seems to have become self-evident. He looks at adaptation through a political ecology approach, and argues that we should be extremely careful with such thoughts, and that there is a strong tendency to marginalise questions of power and production within climate change (p. 189). Through Taylor's analysis, "climate change emerges as part of ongoing historical processes of socio-ecological transformation predicated upon forms of power operating at varied spatial scales that shape control over land, water, bodies and debt" (p. xiv). Since the capitalist system makes one eager to sell new adaptation products and makes debt building continuous in poor countries, it is a need for a critical view regarding to what extent there is a positive contribution by the adaptation in the Global South, both when it comes to nature and concerns of the society there (Taylor, 2014). Since humans arrived in Cabo Verde, there has first been colonial power over the islands, and a very long ongoing process of adaptation in the degraded environment the colonists have left behind that is also affected by climate change. Bosa's (2015, p. 2642) description of how Cabo Verdeans do not like to be controlled, may be a symptom of their history.

Eriksen, Nightingale and Eakin (2015, p. 523) are reframing adaptation "to capture how politics are embedded in the society's management of change". They describe that processes of adaptation can make a positive change for some people, but be negative to others (Eriksen et al., 2015, p. 523; Taylor, 2014). Further, they conceptualize power and politics, to see how power is "*in action"*, and they see the use of power as "a productive force, one that allows for action and agency and is integral to all human interactions" (Eriksen et al., 2015, p. 527). The concepts of "*authority"*, "*knowledges"* and "*subjectivity"* are used to "probe how society-climate change dynamics are bound up in struggles over authority, knowledge and subjectivities across scales" (p. 527). There are various institutions and organisations that are related to climate change adaptation; "incorporating not only those of formal government (which often include public-private collaborations and interactions) and formally constituted policy spheres (for example watershed councils, NGO-industry roundtables, community user-groups), but also other modes of governance such as traditional authorities, neighbourhood coalitions, and social movements" (p. 527). Since power is operating both within and between different organisations, institutions and actors, and on different levels (Leach et al., 2010 as cited in Eriksen et al. 2015, p. 527), it forms who that is allowed to forward adaptation attempts, and in which way (Eriksen et al., 2015, p. 527). The different cultural, geographical and analytical values of knowledge of climate change "are at least in part embedded in struggles over authority", according to Eriksen et al. (p. 528). Subjectivities enable us to look at social inequalities as something that can be a ground for resisting domination and questions for alternative ways for climate change adaptation, or it can be continuously disadvantaging for individuals and communities (p. 528).

2.4 Gender gaps related to economic participation and opportunities

Although there is a low gender gap in Cabo Verde with regards to health and life expectancy, there are high gender gaps when it comes to economic participation and opportunities (World Economic Forum, 2015, p. 134). The rural areas have the largest gender differences in the labour force, according to Marone (2016, p. 12). It is young women between 15 and 24 years old in rural areas that have the highest unemployment rates (p. 17). Among women, unemployment can be twice as high than among men, according to Marone (p. 12). According to Cabo Verde's report of Sustainable Development Goals, employed women are often disadvantaged, due to employment of low quality and because of domestic or informal work (Governo de Cabo Verde, 2018, p. 58). Marone (2016, p. 20) suggests that there could be a

need for gender-based policies and seek to improve the opportunities for work for women including in agribusiness. To break down data by gender for evaluating policies, et cetera, may also be of importance, according to Marone (p. 20).

It is, however, important to keep in mind that there might be limitations with international measures of gender differences. Use of national data or in-depth research on a microlevel may give more precise results (Charmes & Wieringa, 2003; Chant, 2006). Aspects such as informal economy, agricultural work, as well as domestic, reproductive and care work are not necessarily included in international measures but are also of relevance (Charmes & Wieringa, 2003). In the informal sector in Cabo Verde, 58.8 % of the workers were women, and 41.2 % of them were men in 2015 according to information from INE (2017, p. 53).

Cornwall (2003) find it vital to keep a continuous gender perspective in processes of participation and avoid that groups are being marginalised or excluded in development projects. The empowerment of women, as well as marginalised groups, is crucial according to Cornwall. It is necessary to include all gender in development projects to avoid marginalisation not only of females but also for instance young males (Cornwall, 2003, p. 1337; CGTN Africa, 2016; Larsen, 2019). In Cabo Verde, this is important since previous development and empowerment projects often have had a strong focus on women, and not included men and other genders sufficiently (Cornwall, 2003; CGTN Africa, 2016). There has further been a lack of Cabo Verdean's perspective of gender and development in empowerment and development work (UN Women 2014).

Sudarkasa's (1986, p. 101) study of pre-colonial Western Africa gives a different perspective of gender roles, with the term "*neutral complementarity"*. According to Sudarkasa, women and men seemed to have had different roles in pre-colonial Western Africa but there still seem to have been a neutrality between genders and their roles, instead of a hierarchical order (pp. 101-102). Sudarkasa found that it was colonialization and capitalism that contributed creating a hierarchy between genders in Western Africa (p. 102).

2.5 Poverty and policies

Rodrigues (2008) states that policies in Cabo Verde after independence, like cash for work programs "guaranteed minimal cash flow in rural areas to secure money for food" (p. 359). Food was distributed by a new maritime transportation system, and by government companies

that held government-controlled prices, according to Rodrigues (p.359). Because of this, the Cabo Verdeans survived severe droughts (p. 359). Food security is increasingly connected with earning of wage, and not just whether there is food locally or not ("Huss-Ashmore, 1989; Sen, 1981; Shipton, 1990" as cited in Rodrigues, 2008, pp. 370-371). But not having "a solid program for agricultural investment" ("Huss-Ashmore & Thomas, 1988; Huss-Ashmore 1989" as cited in Rodrigues, 2008, p. 371), and to be dependent on wage-earning from the service sector only, is proven to be unsafe in Sub-Saharan Africa (p. 371).

The study of Corral et al. (2017, p. 10) shows how more recent agricultural policies have led to less poverty in three water basins in Cabo Verde. Corral et al. addresses remaining challenges, especially with lack of water. (p. 15) It further seemed that farmers were not sufficiently involved during the work with a water project, even though they participated in the process (p. 12). Corral et al.'s findings showed that the implementations of the project were not always sustainable after its end, and some farmers did not consider the implementations as private properties (p. 12). Increased cooperation seems could help the farmers to achieve common goals, Corral et al. found (p. 16). Gender issues were also a challenge (p. 16).

2.6 Water and land management

Haagsma (1995) describes how farmers in Santo Antão had developed their traditional irrigation system themselves. This was "well-adapted to extremely difficult physical conditions of steep slopes and limited water flow" (p. 39). Haagsma tells that especially after independence, the government made efforts to make irrigation systems more efficient, by using large employment schemes to develop them. The farmers' irrigation infrastructure per system was improved by this, but not the river basin since there was no change in the availability of water (p. 50). Farmer participation in the maintenance of the systems became reduced, as the farmers were not listened to, the employment schemes did not include them as workers, and they felt that the constructions were not theirs, but state properties, according to Haagsma. There was also a lack of trust between the farmers and the state (pp. 53-54). Haagsma argues, that the responsibility for problem-solving in these kinds of construction activities rather should be given to the farmers, while the government should be the "stimulator, or facilitator" (p. 55).

There are both public and private institutions, as well as informal non-institutional water management in Cabo Verde, according to Bosa (2015). This can explain why it can be difficult

to ensure sustainable water management after a project ends, if it is not followed up by public institutions, if the project has been carried out with too little cooperation with the farmers, and the farmers do not feel ownership to the irrigation system (Bosa, 2015; Corral et al., 2017). "The private management of a common resource predominates in managing the water from the nascentes or springs, whereas in the case of the furos or large wells, although the water belongs to the state, it comes under community management in most cases" (Bosa, 2015, p. 2642). The water in "nascentes" is connected to land ownership, and such water management in Cabo Verde is often informal, and not institutional, according to Bosa. The state has problems imposing its authority in relation to water management, and "institutional legality exists side-by-side with tradition" (Bosa, 2015, p. 2642) that do not like to be controlled (p. 2642).

Baptista (2016) finds that it is possible to increase yields in the Ribeira Seca watershed by the use of technology and that erosion also could be reduced. But this is something that farmers may not be able to afford. Baptista et al. (2015) argue that Cabo Verde should strengthen their policy with regard to sustainable land management (SLM) practices to achieve optimized soil and water management. Both to reduce degradation of land and desertification, and because of global concerns like scarcity of water, efficient use of resources, food security, poverty, climate change, and conservation of biodiversity (p. 39). Most of the efforts in Cabo Verde regarding SLM measures seek to improve land management as a whole, but soil needs to be treated as a limited and threatened resource, according to Baptista (2016, p. 152).

2.7 Insurance, benefits and funds

A strategy to establish a program for climate insurance that specialises in the support of countries in the Global South in the adaptation to climate variability risk is suggested by Linnerooth-Bayer and Mechler (2006). This is also related to the intentions of Article 4.8 of the United Nations Framework Convention on Climate Change (UNFCCC). The strategy is meant to support countries in the Global South when it comes to insurance-related initiatives that are concerned with weather-related disasters, both sudden- and slow-onset (Linnerot-Bayer & Mechler, 2006). This could be of importance to Cabo Verde that has previously been thought of as uninsurable (Djohy, 2017). The advantage of index-based insurance is that it requires less administration since it is very general, but it does not cover more specific or individual losses according to Djohy. There has also recently been implemented an unemployment benefit in

Cabo Verde for beneficiaries of "Sistema de Proteção Social Obrigatório" (INPS, 2019). This is a very important step to reduce poverty.

Zougmoré, Partey, Ouégraogo, Torquebiau & Campbell (2018) state that major steps are evolving in Africa to promote agricultural insurance. In Ghana, a concept of crop insurance has been developed that is weather-index based and the Ghana National Insurance Commission attempts to implement a farmer-led, participatory approach to insurance, according to Zougmoré et al. In Malawi, a combined index-based insurance and loan were developed in 2005, to which several thousand farmers subscribed to (p. 7). But to implement insurance large-scale is a high-risk task since there are many challenges and many uncertain things (p. 7). There are "[…] doubts about the appropriateness of indices for payment, clear definition of risks, difficulties for implementation in the absence of public funds, farmers' perceptions and unwillingness of some private financial companies" (p. 7).

Afful-Koomson (2015) made an analysis before the Green Climate Fund was started, based on data of climate change projects that were financed by other climate funds. Afful-Koomson analysis indicated that it was mainly small-scale projects, with high transactions costs that followed, which were financed by climate funds. To reduce transaction costs, small projects could be gathered or it could be given resources for templates project could follow, tools that could be used as well as data banks, Afful-Koomson suggests (p. 377). Climate funds could also increase their scope for possible projects of medium-/large-scale (p. 377). There should also be included some emerging countries to contribute to climate funds (p. 370). Donors and recipients may need to work together to better the 'predictability' of the climate funds' financial flow (p. 377).

2.8 Migration to reach a normal life

The issue of migration is a part of Cabo Verdeans everyday life, according to Åkesson (2008). Many local Cabo Verdeans know and frequently communicate with friends or relatives living in other countries and receiving remittances is also common (Åkesson, 2008). Åkesson states that it by many is seen impossible to reach a normal Cabo Verdean life by remaining behind (p. 278). People therefore have relations with more places (p. 278). The Cabo Verdean society often sees migration as a way of achieving a normal and stable life (p. 278). And a "normal life" usually means to be able to set up an own house and have their own decision-making

abilities, by economic means and social power (p. 277). Few countries in the world have been so dependent on migration as Cabo Verde (Carling, 2004), and it is likely that the number of Cabo Verdeans living in other countries is larger than the population on the islands (Carling, 2004; Åkesson, 2008).

3. THEORETICAL FRAMEWORK AND METHODOLOGY

In this chapter, the theoretical framework related to climate change adaptation and gender, that are the base of this thesis, is explained. Also, the methodology that is being used in this research is presented.

3.1 Theoretical Framework

Cabo Verde has a long history of colonialization, environmental degradation, restoration and adaptation (Batalha & Carling, 2008; European Commission, 2016; Haagsma, 1995; Baptista, 2013; Sieff, 2017). Political ecology is a theoretical approach which is relevant in relation to the thesis' problem statement (Blaikie, 2010). Taylor (2014) and Eriksen et al. (2015) are therefore being used to look at different aspects and sides of adaptation. This is done by looking at local perceptions of what climate change adaptation that is needed and how this corresponds with the experienced ongoing adaptation process. Additionally, it is looked into positive and negative sides of adaptation, and differences between groups and / or people in this respect. Democracy in the adaptation process is also questioned. The gender theories of Cornwall (2003) and Sudarkasa (1989) are used while keeping an eye on gendered perspectives of women and men during the research. These four theories are being used as basis to describe local perceptions of climate change adaptation in Santa Cruz and present the data in the thesis (Blaikie, 2010, p. 69).

3.1.1 Taylor: Adaptation and questions of power

According to Taylor (2014, p. 189), the reasons for the ongoing mainstreaming of adaptation seem to be self-evident. Because of the vulnerability of especially the poor living in rural areas, shifts in the climate caused by climate change and rising temperatures, adaptation appears as a very urgent and also natural response to these circumstances (p. 189). But Taylor argues that we should be extremely careful of such thoughts (p. 189). Adaptation should be seen "as a discourse – a set of relations between forms of knowledge, structures of power, institutional practices and prevailing technologies" that outlines how we understand and respond to changes socially and ecologically (p. 56). Climate change adaptation should also be problematised and considered in democratic and political processes (p. 51). Structures like gender, class and social groups are important to be aware of in this respect (p.74). Taylor reminds of how questions of power easily can be marginalised, and that "technocratic colonisation" may be a consequence of this (p. 65).

This research builds on Taylors' (2014) critical focus on adaptation by questioning the need for adaptation, if locals gain from adapting, and by looking at both positive and negative sides of adaptation. Also, differences between groups and people are being questioned. All by focusing on the locals in Santa Cruz's own perspective on adaptation.

3.1.2 Eriksen, Nightingale & Eakin: Adaptation and social inequalities

Eriksen et al.'s (2015) reframing of adaptation, "to capture how politics are embedded in society's management of change" (p. 523), is therefore highly relevant. Adaptation processes can be positive for some people and support beneficial changes in livelihood for them, but at the same time, be negative for others (Eriksen et al., 2015, p. 523; Taylor, 2014, p. 79). Eriksen et al. (2015, p. 527) conceptualize power and politics, to see how power is '*in action'*, and they see the use of power as a productive force that creates action and agency, integrated in all the human interaction. Further, they use the concepts of '*authority'*, '*knowledges'* and '*subjectivity'* to investigate how the dynamics of society-climate change are "[…] bound up in struggles over authority, knowledges and subjectivities across scales […]" (p. 527).

Since power is operating both "within and between" various organisations, institutions and actors, and on different levels (Leach et al., 2010 as cited in Eriksen et al. 2015, p. 527), it forms who that is authorised to promote adaptation and in which way (Eriksen et al., 2015, p. 527). The different cultural, geographical and analytical values of knowledge of climate change "are at least in part embedded in struggles over authority", according to Eriksen et al. (2015, p. 528). Subjectivities enable us to look at social inequalities as something that can be a platform for resisting domination and ask for alternative ways for climate change adaptation, or it can be continuously disadvantaging for individuals and communities (p. 528).

In this research, Eriksen et al.'s (2015) theory is being used to keep a focus on local 'knowledges' and what they consist of. Further, the research questions social inequalities which can make a platform for 'subjectivities' that can resist ongoing adaptation that eventually not is in line with their 'knowledges', and ask for climate change adaptation that correspond more with their own knowledge of adaptation related to climate change in Santa Cruz (Eriksen et al., 2015). Power and struggles over 'authority' are also considered in line with Eriksen et al.'s theory.

3.1.3 Cornwall: Gender in focus

Since there is a large gender gap regarding economic participation and opportunity in Cabo Verde, according to the World Economic Forum (2015), it also is interesting to look at Cornwall's (2003) theory.

According to Cornwall (2003), it is vital to keep a gender perspective in the processes of participation and avoid that groups are being marginalised or excluded in development projects. The empowerment of women, as well as marginalised groups, is crucial according to Cornwall (Larsen, 2018).

The inclusion of all genders, meaning both women and men, as well as other genders in development projects like empowerment and education, is necessary also to avoid marginalisation not only of females but also for instance young males (Cornwall, 2003; CGTN Africa, 2016; Larsen, 2019).

In Cabo Verde, it is relevant to keep all genders in mind, since most development and empowerment projects have had a strong focus on women, and not included men and other genders sufficiently (Cornwall, 2003; CGTN Africa, 2016; UN Women, 2014; Larsen, 2019). There has also been a lack of Cabo Verdean's perspective of gender and development in empowerment and development work (Larsen, 2019; CGTN Africa. 2016; UN Women, 2014).

Based on Cornwall (2003) this research focuses on gender differences between men and women through all research questions. Also, it ensures that half of the respondents are women and half men, and analyses both men's and women's views of adaptation related to climate change.

3.1.4 Sudarkasa: Gender in precolonial Western Africa

Sudarkasa's (1986, p. 101) study of pre-colonial Western Africa gives a different perspective of gender roles, with the term "*neutral complementarity"*.

According to Sudarkasa, women and men seemed to have had different roles in pre-colonial Western Africa but still to have had a neutrality between genders and their roles, instead of a hierarchical order:

> "It is well known that African women were farmers, traders, crafts producers in different parts of the continent. It is equally well documented that their economic roles were at once "public" and "private". … In the economic sphere more than in any other it is easy to show that women's activities were complementary to those of men and that women producers and traders were not subordinate to men."
>
> (Sudarkasa, 1986, p. 100)

Sudarkasa meant that colonisation and capitalism had contributed to create a gender-hierarchy in Western Africa (p. 102). Her study gives a perspective of gender where neutrality may be an option to achieve equality while men and women still may have different roles in the society. This may give a larger variety of skills and task being done when roles are different but with equal worth, than if roles should be more equal, which may be very useful especially in poor countries, depending on what the local people themselves prefer (Larsen, 2019).

This research considers Sudarkasa's (1986) study in that there is not only one way to give equal worth to different genders and by focusing on more equality between gender roles. As Cabo Verde is a West African country, Sudarkasa's study is considered relevant for the research there.

3.2 Methodology

For this research that has a large focus on the respondents' own perceptions about ongoing and needed adaptation concerning climate change, qualitative methods were chosen to get a better insight into the knowledge and viewpoints of the locals (Bryman, 2016, p. 466; Blaikie, 2010, p. 207). This includes fieldwork with observations, and qualitative interviews of local inhabitants/farmers in Santa Cruz Santiago, Cabo Verde (Bryman, 2016). The fieldwork had a duration of three months from January to April 2019.

The methodological purpose of the research is to explore and describe experienced climate change adaptation strategies and compare it to the locals' desired adaptation (Blaikie, 2010, pp. 70-77). In the research there is a higher extent of focus on the locals' own viewpoints of climate change adaptation collected in qualitative interviews, and a lesser extent of focus on the researcher's viewpoints (Blaikie, pp. 89-91 & p. 154). Still, the research questions and the interview guide are made prior to the research based on existing theories and secondary literature. Observation is also conducted. A combination of qualitative research strategies is being used.

The research statement and research questions were made prior to the fieldwork based on the theoretical framework of the study and the secondary literature (Bryman, 2016, p. 23). The five research questions are asking "what"-questions to get an insight into the local people's perceptions and describe them (Blaikie, p. 62). Semi-structured qualitative interviews with an interview guide were used, to be able to adjust the interview according to respondents' different views of adaptation (Bryman, 2016, pp. 466-469) and to be able to let the respondents describe more freely their experiences and viewpoints regarding climate change and adaptation (Blaikie, 2010, p. 207; Bryman, 2016, p. 466). The interview questions in the interview guide were made prior to the fieldwork, based on the research questions, the theoretical framework and the secondary literature (Bryman, 2016, p. 23), with a critical focus to let the respondent talk about both negative and positive sides of adaptation, as well as differences between groups and between people. Additional questions were sometimes being asked during interviews to get a better understanding of the respondents' viewpoints, or to follow up their answers to get more information about climate change adaptation.

Data collection related to a rural agricultural community was chosen prior to the fieldwork because of the topic adaptation and climate change, as well as the persisting poverty in rural

districts in Cabo Verde. After arrival in Cabo Verde, information was received from locals about and possibilities for research related to climate change adaptation on the Cabo Verde Islands, where Santa Cruz were mentioned as a possible location amongst other locations. A local tour guide on Santiago Island thereafter was employed as an interpreter for the research, due to his skills of both English and Cabo Verdean Creole, as well as extensive knowledge of Santiago Island. Several locations on Santiago Island were considered as research areas based on secondary literature and in cooperation with the interpreter. Based on information from locals, the Rocha Lama plantation in Santa Cruz was considered as a good location to collect information in relation to the research questions about climate change adaptation, and it was decided to conduct interviews and observations there. According to secondary literature, it was assumed that some of the respondents most likely had problems with securing a living in this area and it was not known to have been any recent projects there. At the same time, Rocha Lama seemed relevant in terms of climate change adaptation since they had experienced a reduction of yields and experienced problems, according to the interpreter. It was also an important aspect that the interpreter could act as a "gatekeeper" in the plantation (Bryman, 2016, p. 428).

The interviews were recorded with a Dictaphone without connection to the internet (NSD, n.d.). The questions were first asked in English, and a local interpreter thereafter asked the questions in Cabo Creole. The respondent answered the questions in Creole and the interpreter immediately translated each answer orally from Creole into English, which also was being recorded. A few respondents understood some English and answered some questions in English. Parts of the answers from the respondents were noted in a notebook. After the interviews, the recordings were transcribed into written form. It was the interpreter's translation that was transcribed (and in a few cases parts of the original answer, if I was sure to have understood the meaning in Creole).

This study was approved by the Norwegian Centre for Research Data, and their regulations were being followed before, during and after the collection of data (NSD, n.d.). Several ethical considerations were taken, and all of the research was being made overt (Bryman, 2016, p. 434). An information letter written in Portuguese was given to the participants before the interviews with information about the purpose of the project and what the participation involved, or it was read aloud by the interpreter to participants that could not read. Oral consent was received from participants before interviews or observations were conducted. To protect the privacy of the

respondents, fictive names are being used in the thesis. The collected data is deleted and maculated by the end of this study (NSD, n.d.).

Field-notes were written during the research, as well as photos were taken from the agricultural field and surroundings, to help remember relevant information (O'Reilly, 2012, pp. 102 & 161). The photos do not identify any persons due to ethical considerations.

Secondary information from the literature review was also being used, to give a broader understanding and perspective of climate change adaptation as well as gender in Cabo Verde.

As there seems to be a gender gap related to economic participation, opportunity and job vulnerability in Cabo Verde (World Economic Forum, 2015; Governo de Cabo Verde, 2018), 50 percent of the data was being collected from women and the other half from men, to be able to identify eventual gender-related issues in the analysis. It was considered relevant to collect data from respondents of various ages, to ensure representation of different age groups, as there might be differences in opinions and needs. The background of the respondents is being further described in section 4.1.

Non-probability sampling was being used (Blaikie, 2010, p. 176). The persons interviewed in the Rocha Lama plantation and agricultural area were chosen amongst the people we met there, according to the preferences of gender and age. In Rocha Lama, the interpreter knew some of the locals and respondents. One of the respondents, we were advised to interview by locals, because of his particular knowledge of climate change adaptation. One volunteered to be interviewed after hearing about the topic of climate change adaptation. The interpreter's role as gatekeeper gave access to observations of the agricultural field and insight into the adaptation which, as Bryman (2016, pp. 428-429) states, is an important part of research. To interview more female respondents, the research was expanded to Achada Fazenda/Achada Colaço. It was also considered relevant to interview women at the fruit and vegetable markets in Praia, because they collected fruits and vegetables from the agricultural field which they sold at the market. During the fieldwork we found that they had more time to participate in interviews at the market. We, therefore, interviewed women at two fruit and vegetable markets in Praia and ensured only to interview fruit and vegetable sellers who were living or working in Santa Cruz (by asking for sellers from the Pedra Badejo area). Interviews were conducted until the point was reached where there was considered that it was not learnt new things about local climate change adaptation in relation to the research questions any longer (Blaikie, 2010, p. 91).

The researcher did not know which forms of climate change adaptation that existed in Rocha Lama, Achada Fazenda/Achada Colaço and Pedra Badejo prior to the fieldwork, and this was abductively explored during the fieldwork (Blaikie, 2010, pp. 89-92). The structure of the empirical findings in chapter four builds on the interview guide and the answers from the respondents together with secondary literature. Recordings of interviews were listened to several times and when the interpreter's translation of answers is directly quoted, this is accurately done word for word. Data related to the research question concerning locals' perception of what adaptation that is needed, was also categorised based on the answers from the respondents (Bryman, 2016, pp. 584-588; Blaikie, 2010, p. 91). This to get an overview over which forms of adaptation that was found necessary, see the numbers and percentage of requests for it, and describe needs of adaptation (Blaikie, 2010, p. 92). The data is presented in categories of "women", "men" and in "total". The data collected in the field was further thematically sorted due to answers from the locals, coded, and analysed in relation to the research questions (Bryman, 2016, pp. 584-588; Blaikie, 2010, pp. 84 & 92). All of the data was also being analysed in the gender categories of women and men (Cornwall, 2003). The analysis is presented in chapter five.

The findings of the research are mainly based on the locals' own subjective experiences and viewpoints and do not include any formal institutions' or governments' perspectives concerning climate change adaptation except what is found in the secondary literature.

Although the research attempts to present the locals' viewpoints of climate change adaptation, the theoretical framework and the researcher's perspectives and interpretations also shape this study, particularly since the researcher is not from Cabo Verde (Blaikie, 2010, pp. 91, 154 & 217). Also, the local interpreter's perspectives contribute to shape this study. Limitations of the study are also further described in section 4.9.

4. EMPIRICAL FINDINGS

The empirical findings from interviews and observations related to climate change adaptation in Santa Cruz Municipality on Santiago Island, Cabo Verde, is presented in this chapter.

4.1 Introduction

The research was conducted by 26 semi-structured interviews with 26 respondents; 13 women and 13 men that were either working or living in Rocha Lama, Achada Fazenda, Achada Colaço or Pedra Badejo. Observations were also carried out, mostly in the Rocha Lama agricultural area.

Overviews over the respondents' age, education, location and activity, divided in gender are given in the tables 4:1 to 4:4.

Table 4:1 Respondents' age and gender divide

Age	Female	Male	Total
18-20 years old	-	1	1
20-29 years old	2	2	4
30-39 year sold	5	4	9
40-49 years old	4	-	4
50-59 years old	1	3	4
60-69 years old	1	2	3
70-79 years old	-	1	1
Total	13	13	26

Respondents' age varies between 19-76 years old, and most age-groups in between are represented for both genders. Exceptions are that no women under 20 or over 65 were interviewed, and that no men between 40 and 49 were interviewed.

Table 4:2 Level of education and gender

Education	Women	Men	Total
Primary school up to 4th class	4	6	10
Primary school between 5th and 6th class	3	2	5
Middle school 7th-9th class	1	2	3
Secondary education 10th-11th class	2	-	2
High school	-	2	2
University	2	1	3
No data	1	-	1
Total	13	13	26

The respondents, both men and women, had variation in the level of education from only 1 year at school to university education. More than half of the respondents had only primary education, and more than 1/3 only from 1st to 4th class. Three respondents had a university education (ongoing or completed).

Table 4:3 Respondents' location and gender

Location	Women	Men	Total
Rocha Lama	3	12	15
Achada Fazenda /Achada Colaço	4	1	5
Pedra Badejo (fruit sellers at markets in Praia)	6	-	6
Total	13	13	26

There were differences in the location of most of the men and women that were interviewed. Most of the women were living or working in Achada Fazenda, Achada Colaço or Pedra Badejo. The men were working in Rocha Lama, except one man that was living and/or working in Achada Fazenda/Achada Colaço.

Table 4:4 Respondents' activity

Activity	Women	Men	Total
Mixed agriculture (some including grogue and/or livestock)	-	7	7
Mixed agriculture + selling fruit/vegetables, or other work	4	1	5
Irrigated agriculture	1	2	3
Irrigated agriculture and other work	-	2	2
Rainfed agriculture (when possible) + selling fruit/vegetables	4	-	4
Grogue production and livestock	-	1	1
Fruit/vegetable seller or preparer of animal food	2	-	2
Other work (non-agricultural)	1	-	1
No work	1	-	1
Total	13	13	26

24 of 26 of the respondents were active with agriculture and/or with selling fruits and vegetables.

Twelve of the men worked in mixed (irrigated and rainfed) or irrigated agriculture. Five of the women worked in mixed (irrigated and rainfed) or irrigated agriculture. For those who produced grogue (sugar cane spirits), this was limited to 6 months of the year by the government according to respondents.

Four of the women were active with rainfed agriculture when/if it was possible (sometimes one time yearly) and/or with selling fruits and vegetables. Some of the respondents had given up rainfed agriculture because it had not rained enough in the last years. One of the women was not active in agriculture and did not have work. Also, one of the men expressed that there was no job to do related to agricultural activity, which normally was his only work when the research was conducted.

Five of the respondents had other work in addition to agricultural activity.

Amongst the respondents, 11 live in large households with for example many adults and many children (as often parents live together with adult children and their grandchildren).

4.2 Climate change impacts including locals' experiences

4.2.1 Locals' experienced climate change impacts

In the interviews, the locals were asked if they or local people they knew of had experienced any climate change impacts.

All 26 respondents answered that they had experienced climate change impacts. Some added that "a lot of" locals or "all" experienced it.

Table 4:5 Climate change impacts mentioned by respondents

Impacts	Women	Men	Total
Less rain	12	12	24
More sun and/or warmer temperature	6	5	11
Plant diseases	1	7	8
Less water	1	4	5
Need for pesticides	-	3	3
Reduced water quality	-	2	2
Need for irrigation	1	1	2
Need for fertilizers	-	1	1
Soil problem	-	1	1
Afraid to plant vegetables/fruits	-	1	1
Fewer jobs because of less rain	1	-	1

As many as 24 of the 26 respondents answered that they have experienced reduced rainfall as an impact of climate change. Less water is mentioned by 5 respondents, and some also tell that worsened quality of water, for example saline water, is an impact. More sun and warmer temperature generally or warmer summers and colder winters, is felt by many, depending on the location of the respondents.

As there is not much natural rain, and the water quality is not so good, there are diseases and sickness both affecting the plants and the soil. Especially the papaya trees and manioc were affected by diseases during this study. There is a need for using pesticides. Locals also experience a reduced soil quality. Respondents furthermore told that they experience less yields of vegetables and fruits.

4.2.2 Rainfall and temperature

The Climate Change Knowledge Portal (World Bank, 2020) shows the local average temperature and rainfall for the Santa Cruz location (latitude 15,12, longitude 23,52):

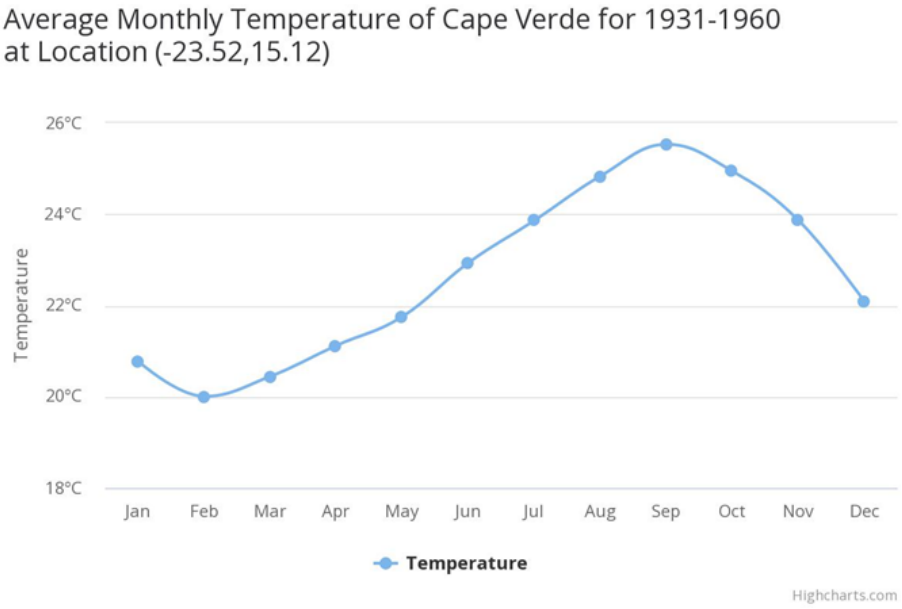


Figure 4:1 Temperature in Santa Cruz 1931-1960

(World Bank. Climate Change Knowledge Portal, 2020)

When seeing the average temperature in Santa Cruz for the period 1931-1960, we can see that it went down to 20,1°C in February, and up to 25,53°C in September (World Bank, 2020.)

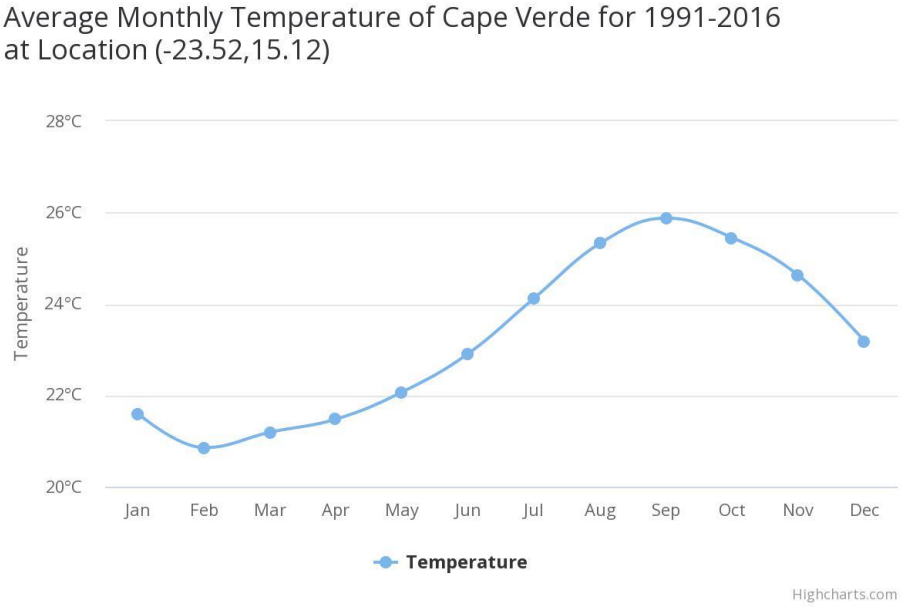


Figure 4:2 Temperature in Santa Cruz 1991-2016

(World Bank. Climate Change Knowledge Portal, 2020)

In the period 1991-2016 the average temperature only went down to 20,85 °C in February, and went higher up, to 25,88 °C in September (World Bank, 2020). In this period all of the months are on average warmer compared to the period 1931-1960, except June which is 22,92 in this period compared to 22,93 in the period 1931-1960.

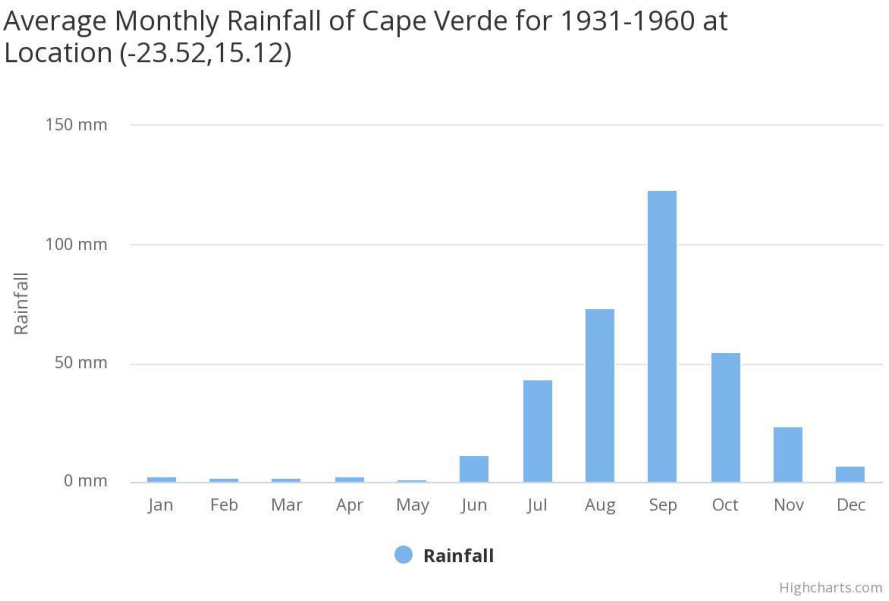


Figure 4:3 Rainfall in Santa Cruz 1931-1960

(World Bank. Climate Change Knowledge Portal, 2020)

The average rainfall was up to 122,98 mm in September and down to 1,19 mm in May, in the period 1931-1960 (World Bank, 2020).

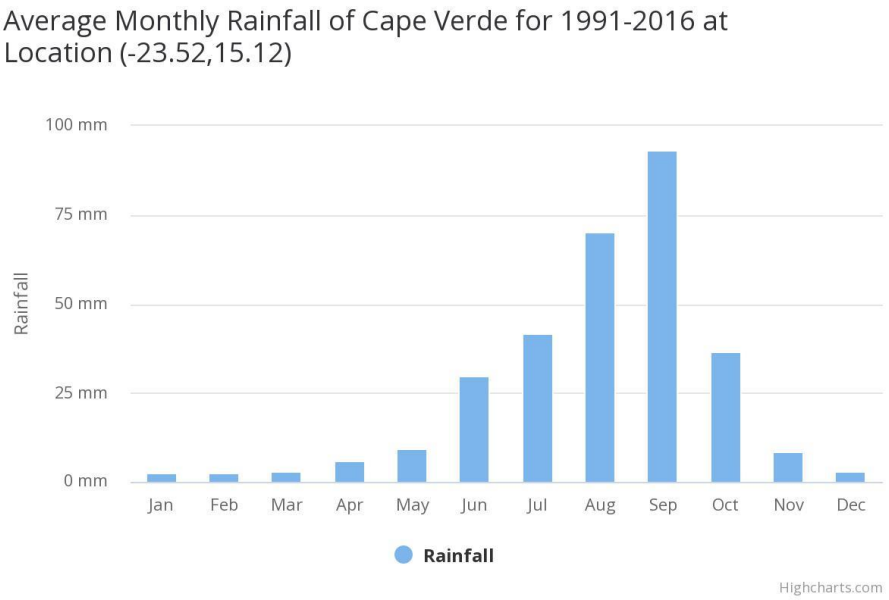


Figure 4:4 Rainfall in Santa Cruz 1991-2016

(World Bank. Climate Change Knowledge Portal, 2020)

For the period 1991-2016, the average rainfall was only up to 93,28 mm in September and down to 2,35 mm in January (World Bank, 2020). When comparing average monthly rainfall in Santa Cruz for the period 1991-2016 with the period 1931-1960, it shows a reduction in all of the months from July-January, which includes the period of the rainy season. For the period February-June there is some increase of rainfall in this period.

Statistics of rainfall for Pedra Badejo in Santa Cruz shows that there had been a reduction of average rainfall for three years, from January 2016 lasting until this study was conducted in spring 2019 (Word Weather Online, 2020; FAO, 2018a). This compared with the average monthly rainfall for 1991-2016 (World Bank, 2020).

4.2.3 Impacts of shortened rainy seasons on agricultural production

When the research was carried out, there had been three years with little rainfall in Santa Cruz (World Weather Online, 2020; FAO, 2018a). Many of the respondents were concerned about this. "Lenira" (43) works with agriculture and runs her own store. She tells: "It used to rain before the 25th of July, but not anymore". Lisa [author]: "What time does it start to rain now?" "Lenira": "In September. And sometimes it doesn't rain".

Change of agricultural conditions have impact of the yields of fruits and vegetables. "Dulcina" (40) is a banana seller and head of a household of 7 people, She explains that "I used to take 1,000 kilos of bananas, but now it is less than half." Lisa: "At what time was it 1,000 kilos?" "Dulcina": "3 years ago."

Also "Edmilson", a 31-year-old farmer, tells a similar story: "Three years ago there were 1,000 kilo bananas in a month in this area. But now it is only 100 kilo bananas per month. Last year there were 1,000 kilo potatoes, but it is 300-kilo potatoes only now."

Climatic models during the National Adaptation Programme of Action (NAPA) assessment showed that climate-related disruptions may lead to shortened rainy seasons, with its immediate impact on livelihood and agriculture (World Bank, 2019a, para. 1).

In 2019, when this study was conducted the drought was so severe that many of the respondents were not doing rainfed agriculture, since it gave little or no vegetables, as there had been little rain in Santa Cruz, Santiago, for the last three years (World Weather Online, 2020; FAO, 2018a).

According to the World Bank (2020, para. 2), the average temperature in Cabo Verde has increased by 0.6°C from 1960 to 2006. The rate of increase is highest in the wet season, with "ASO [August, September and October] at 0.23˚C per decade" (McSweeney et al., 2012, p. 1). The temperature increase will continue in the following decades (World Bank, 2020, para. 2; McSweeney et al., 2012, p. 2).

4.3 Experienced adaptation

This section, including table 4:6, gives an overview of the adaptation locals experience in Santa Cruz.

Table 4:6 Overview of experienced adaptation in Santa Cruz

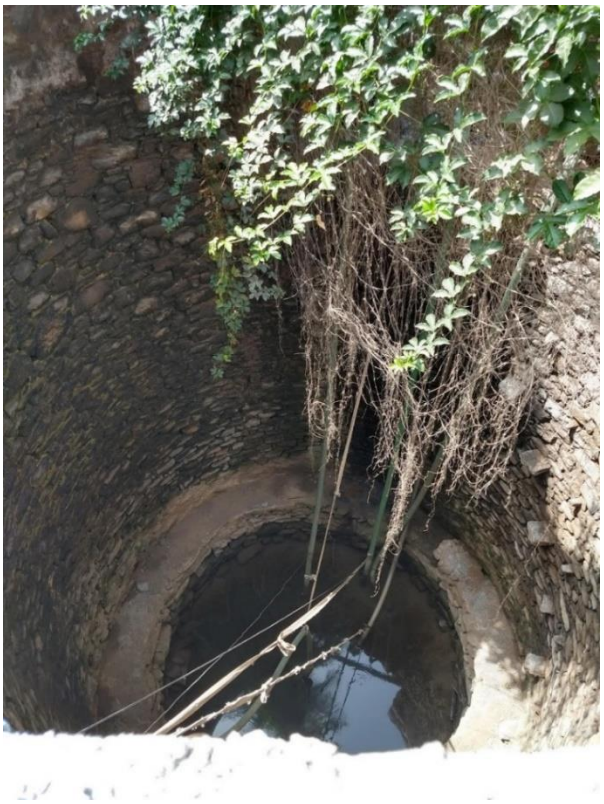
Experienced adaptation	Women	Men	Total
Pesticides/medicaments	8	9	17
Drip irrigation ("Gota a gota")	7	8	15
Water irrigation (except drip-irrigation)	3	2	5
Fertilizer	2	1	3
Dam/Water reservation (but dry, or often lacks water)	-	2	2
Reservation dam (tank to keep the water)	-	1	1
Animal food	1	-	1
Cover to keep animal food	-	1	1
Cultivation of other plants (more bananas, fewer maniocs)	1	-	1
Bank loan for drip irrigation	1	-	1
Fresh (non-saline) water	1	-	1
Improved water quality (still waiting for it)		1	1

4.3.1 Previous adaptation related to climate change in the study area in Santa Cruz

Experienced adaptation both genders tell about is most often pesticides and drip-irrigation. "Anilton" (32), is one of few respondents that had drip-irrigation, which he financed by a loan. Also, water wells/irrigation were mentioned, as well as water dams (one or more dam(s) was not working). Fertilizers are also a form of adaptation which was mentioned.

4.3.2 Water "levadas" and water wells in Rocha Lama plantation

With the lack of natural rain, there is a need for other ways of watering the plants in the Rocha Lama plantation.



Picture 4:1 Water well in Rocha Lama, Cabo Verde

Photo: Larsen, L. (2019)

The water in the plantation was being pumped up from water wells by diesel-motors, and manually being led with large tubes into irrigation channels called "levadas", which are made of cement.

Picture 4:2 Water being pumped into temporary reservoirs. Rocha Lama, Cabo Verde.

Photo: Larsen, L. (2019)

Water was then being led/distributed through the "levadas" and through further channels of soil to the desired group of plants and trees.

Picture 4:3 Water "levada" and plants being watered, Rocha Lama, Cabo Verde.

Photo: Larsen, L (2019)

4.3.3 Drip irrigation

Many locals knew about the use of water adaptation in form of drip irrigation. During the research, some use of drip-irrigation systems was also observed. Plants were then watered by the use of small drip-irrigation tubes. The drip-irrigation tubes were placed on the ground and

lead the water directly to the plant through small holes in the tube. This is further described in part 4.4.5 of this chapter.

4.3.4 Pesticides and fertilizers

Climate change contributes to increase of plant pests and diseases, according to clear evidence (FAO, 2020c; FAO, 2008, p. 1). "Changes in temperature, moisture and atmospheric gases can fuel growth and generation rates of plants, fungi and insects, altering the interactions between pests, their natural enemies and their hosts. Changes in land cover, such as deforestation or desertification, can make remaining plants and animals increasingly vulnerable to pests and diseases" (FAO, 2008, p. 1). To reduce plant diseases, adaptation in form of pesticides is being used in Santa Cruz, according to respondents.

Fertilizers are being used as an adaptation strategy for the soil. Fertilizers can be important in climate change adaptation and mitigation if used correctly, according to the Food and Agriculture Organization of the United Nations (FAO, 2016b, p. 2). Soils can store carbon and decrease greenhouse gas emissions in the atmosphere, if it is managed using sustainable soil management (SSM) techniques including fertilizers (FAO, 2016b, p. 2; FAO, 2011, p. 63). Farmers mentioned the use of natural fertilizers ("adub"), and some held animals for this reason. There were also told about fertilization in Rocha Lama performed by an external company and/or the government.

Locals told that fruits and vegetables could become misshaped by use of pesticides. "Joana" a 40-year-old fruit seller at the market showed us a deformed vegetable: "This is how it is like to put medicines [pesticides] … It is working really good…But the quality of the fruit/vegetable is not very good when using medicines [pesticides]". Pesticides also have health risks (WHO, 2020). Fertilization could lead to burning of the plants if used incorrectly, according to locals.

4.3.5 Water dam without water

Some of the women told about water dams/reservations in the research area that were empty or did not work much because of lack of rain. This was a widespread problem in Cabo Verde due to drought (FAO, 2018a).

Picture 4:4 Landscape that is drying out in Santa Cruz, Cabo Verde

Photo: Larsen, L. (2019)

4.4 Preferred adaptation by the locals

Considering the impacts of climate change in Cabo Verde, it is interesting to take a closer look at what the locals think about adaptation. Respondents were asked about what kind of adaptation, if any, they eventually find necessary in relation to climate change.

4.4.1 Overview of preferred adaptation

Table 4:7 Preferred adaptation mentioned by locals in Santa Cruz

Preferred adaptation	Women	Men	Total
Water-related adaptation (except drip-irrigation):	***8***	***4***	***12***
More water	2	1	3
Machine to improve water quality	1		1
Tanks/Cisterns	1		1
Big tank with improved water quality	1	1	2
Water conservation to prevent water going from river to sea	1		1
Water "barragem"/dam		1	1
Other	2	1	3
Governmental help/other help with adaptation:	***5***	***7***	***12***
Governmental help with project/jobs/opportunities	2		2
Government should come to see and collect information		1	1
Governmental help needed	3	2	5
Economic help for locals while the soil is left to rest in Rocha		1	1
Improved governmental control over locals' water usage		1	1
Agricultural education in relation to climate change		2	2
Adaptation related to drip-irrigation:	***1***	***4***	***5***
Drip-irrigation/Tank for drip irrigation ("gota a gota")	1	4	5
Financial/other adaptation support:	***1***	***4***	***5***
Financial support, for example for pesticides	1		1
Food for the animals		1	1
Plant new species of vegetables/fruit that is more resistant		1	1
Cover for vegetables/fruits		1	1
Fridge etc. to keep the products cool		1	1
Adaptation related to solar panels:	***1***	***2***	***3***
Solar panels		1	1
Solar panels to make saltwater into fresh/drinking water		1	1
Solar panels for the water pumps	1		1
Religious beliefs related to climate change adaptation:	***2***	***-***	***2***
Waiting for God to bring more rain	2		2

Table 4:7 is based on answers from the respondents, where the preferred adaptation is the local respondents' recommendations. We can see that 11 of the local respondents answered that governmental or other help necessary for climate change adaptation. 9 respondents requested water-related irrigation, and 5 requested drip-irrigation. Also, 5 respondents requested financial or other support for various adaptation strategies. Solar panels were requested by three respondents.

In the figures 4:5 to 4:7, we will see the percentage of requests for different forms of climate change adaptation, first in total in figure 4:5, then by women in figure 4:6 and by men in figure 4:7. "Water-related adaptation", "Governmental help", "Drip irrigation", "Other economic support, etc.", "Solar panels" and "Education and knowledge", "Projects, jobs and opportunities" and "Other" is here listed as own categories, based on the answers from the locals.

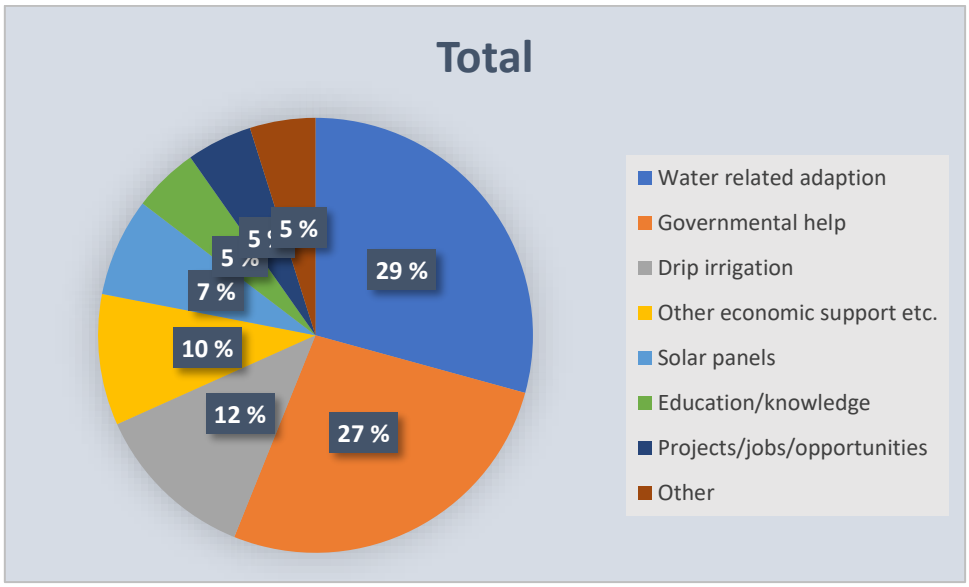


Figure 4:5 Diagram showing preferred adaptation

Water-related adaptation (29 %) and governmental help (27 %) is most requested by respondents. Then follows drip-irrigation (12 %), other economic support or assistance (10 %) and solar panels (7 %), projects, jobs and opportunities (5 %) and education and knowledge (5 %).

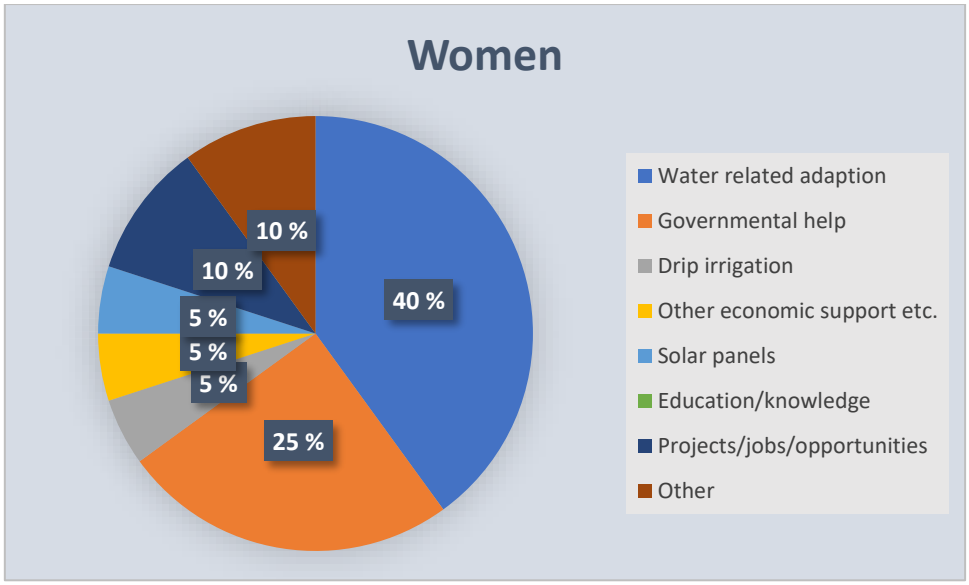


Figure 4:6 Diagram showing women's preferred adaptation

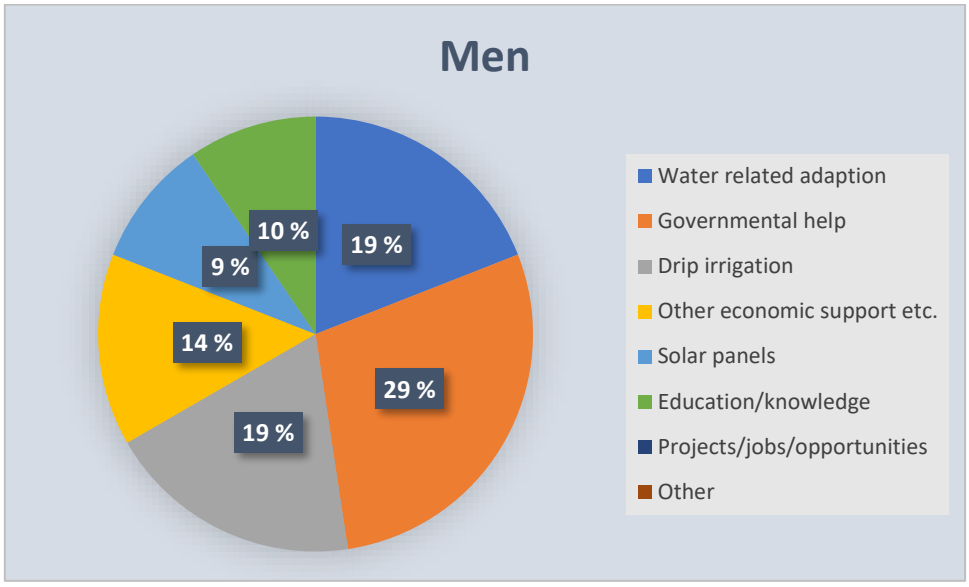


Figure 4:7 Diagram showing men's preferred adaptation

Women and men expressed different preferences of climate change adaptation as is shown in figure 4:6 and 4:7.

Amongst the women, there was 40 % request for water-related adaptation and 25 % request of need for governmental help. Projects, jobs and opportunities were furthermore found necessary. Drip-irrigation, solar panels and/or other economic support or assistance were also asked for by women.

Amongst the men, there was 29 % request for governmental help and 19 % request for water related adaptation and/or drip-irrigation. Other economic support or assistance was 14 % request of by men. More education and knowledge were also expressed as necessary by some men, as well as solar panels.

4.4.2 Natural agriculture as an ideal situation

Some of the respondents mention natural agriculture as their preferred situation. Before, when it rained naturally there was no need for adaptation, they explain. They did not use neither pesticides nor fertilizers. Now the plants do not grow without it. But adaptation is absolutely necessary for the plants to grow, the respondents say, because there are plant diseases and sickness in the soil.

4.4.3 More water

Some of the respondents had lost access to water for agricultural use, as it was no longer water in their areas. This especially applied to respondents in Achada Fazenda and Achada Colaço, and women from Santa Cruz. At the time of writing some respondents had given up rain-fed agriculture, and many had put in on hold, as there had been little rain for three years (World Weather Online, 2020). Some of the respondents requested water-related adaptation from the government.

“Livina”, is 34 and she has almost finished university. She does not find it possible to secure a living at this time in Achada Colaço where she lives, because there is no water for agriculture. The water dam is now empty, so she cannot work at the agricultural area she has, because of lack of water.

In Rocha Lama the water quality was relatively good at the time of the research, and not too saline, according to the respondents. Natural rain was considered better than water taken from the ground, but not available since it rarely rains, perhaps only a few months in a year or almost not at all.

Increased salinity of the water is a risk for Cabo Verde, as climate change can lead to higher sea water levels and coastal erosion (World Bank, 2019a, “Key Vulnerabilities”, para. 1), and dryer ground due to less rain and higher temperatures (World Bank, 2020). Coastal erosion in Santiago island may also be caused by humans (Correia & Pereira, 2016, p. 196). Although the sand is protected in a Decree-Law of the Cabo Verdean government from 1997, poverty still leads locals to collect sand illegally from the beaches in Santiago and sell it, according to

Correia and Pereira (2016, p. 196). Locals told that the police were patrolling the beach in Santa Cruz to avoid sand mining.

Lack of access to water leads to need for tanks, cisterns, water conservation or water barrages in areas in Santa Cruz with lack of water resources. There is a need for preventing water in Santa Cruz from going straight to the sea, according to locals.

4.4.4 Improve water quality

Good water quality is important to avoid soil and plant diseases. As there were no or very little rainfall at the time of the research, the farmers were depended on the quality of the groundwater.

It was expressed by respondents that the more water they use, the more saline the remaining water becomes. Saving water was therefore a concern for them, as saline water is a known problem in the area. Locals point to the need for desalination of the water.

Improved water quality is seen as a necessary adaptation. This seems to be especially relevant in Achada Colaço and Achada Fazenda. At one location in Rocha Lama the groundwater from the wells was being used also for drinking during observation and it was told that it was drinkable. Water quality is also a concern that Baptista et al. (2015, p. 25) mention, in their study in Santa Cruz as saline water leads to salinization of the soil. This again leads to chemical degradation of cultivated land (p. 32).

4.4.5 Drip irrigation saves water and time

Use of drip irrigation ("gota a gota") was seen as a positive way of adapting to reduce the use of water by respondents at all the locations researched. But it depends on having access to water and money to buy drip-irrigation or having to take a loan to get it.

Locals explained their experience with the use of drip irrigation. It has the advantage that it leads the water directly to the plant in smaller tubes on the ground, and thereby reduces the amount of water used. It also requires less time used by the farmer than the traditional way of watering the plants that were observed in the Rocha Lama plantation, described in part 4.3.3 of this chapter. By using drip irrigation, the farmers get more time to do other agricultural work. It also improves the quality of vegetables like tomatoes. Many respondents were waiting for governmental help to get drip irrigation, as they said that they were being promised it, but had not received it.

Picture 4:5 New drip-irrigation system at tomato plantation. Rocha Lama, Cabo Verde.

Photo: Larsen, L. (2019)

"Anilton", a 32-year-old farmer who raises animals and works on irrigated agricultural land expressed that he was satisfied with his drip irrigation: "…because you can save your time and can do a lot of job. You just open [it] … water comes to the plant, and you can cook and do something. That's so good. Everybody knows it is good … And then it is really expensive to put [up the] adaptation system, but it is good". Usually, "Anilton" was very busy working at the plantation, and it took time before we got the possibility to interview him.

Farmers explain that there have been promises from the government about drip irrigation, and many are therefore waiting for it, but not receiving it. Among the respondents, very few had drip-irrigation. "Anilton" had managed to get it, but he had to finance it with a bank-loan.

During the research "Anilton" harvested a high yield of tomatoes, as well as yields of other vegetables.

In Rocha Lama there were large areas of banana plantations that were watered from the wells through the big tubes and irrigation channels. Drip-irrigation or sprinklers were not observed at the banana plantations. It was assumed by one of the respondents in Rocha Lama that drip-irrigation is not useful for bananas. However, there are developed drip irrigation systems and sprinkler irrigation also to be used for bananas (FAO, 2020a, "Irrigation methods", para. 1). This is an adaptation that could be considered.

4.4.6 Governmental or other help

Many of the respondents request governmental help to find a solution, within many of the preferred ways of adapting. Especially related to water, access to water and control over the usage of water. Some respondents do not see any solution themselves and ask for the government or others to help them.

Some respondents asked for projects, for example with help from the government. It is not known that any larger projects have been carried out in Rocha Lama, Achada Facenda or Achada Colaço, but we were told by respondents, and also observed, that there had been assistance from the government and/or an external company with fertilizing the soil around the plants in the plantation in Rocha Lama during the fieldwork. There was also a more general project related to drip irrigation.

The impression was that many respondents that had access to water were waiting for drip irrigation and that they found it too expensive to finance it themselves. Other respondents did not have access to water for agricultural use and were therefore in need of more water. Some of the respondents asked for jobs and opportunities they were in lack of.

"Aline" is a 38-year-old woman that does not work, but she is doing some agriculture for her own consumption. She says: "The government should do something necessary for us to help us … to organise the job, the project. … by borrowing us money …" Lisa: "What would you want to do with the money if you could borrow it?" "Aline": If I find somebody to lend me money, a company or the government, I want to use for the agriculture area and also raise some animals, because I can get some money. Because if you just put it in the land with agriculture, if you lose it, you have no way to pay."

4.4.7 Education and knowledge

Education and knowledge are needed to know how to adapt in a changing climate. There is a need to know which fruits and vegetables to plant and which pesticides to use. While they grew

more manioc in Rocha Lama before, climate change has made many of the farmers change from manioc to bananas. Climate change may require more changes in products in the future. This requires knowledge about which plants that can grow in the changing climate, and how to avoid plant diseases.

“Tote” is 31 years old and has an agricultural education. He helps his mother with agriculture. He explains: “It is a good idea if the government could train the farmers with education to give them more opportunity to know what things they have to do.”

Most of the respondents have very little education. More than half of them (15 respondents) have only primary education (between 1 and 6 years at school). There are 5 respondents that have attended high school or university. All except one respondent explain that they solemnly depend on learning about climate change adaptation from each other in the agricultural field, and most respondents see the need for increased knowledge, courses or education related to agriculture, especially to avoid losses due to plant diseases.

There were plant diseases which according to respondents recently had affected “everything”, papaya, manioc, beans, maize, bananas and cabbage in Santa Cruz. Some had lost all their papayas or manioc due to plant diseases. They expressed the need for more knowledge about which pesticides to use.

Picture 4:6 Papaya tree with disease. Rocha Lama, Cabo Verde.
Photo: Larsen, L (2019)

One respondent that had lost her papayas, had been trying several pesticides that did not work. Another respondent told me that she had managed to save her papayas because she knew which pesticide to use.

The farmers spend much money on pesticides (one of them used 10 Euros per day) and tell that they may have to try many different types of pesticides to avoid plant diseases. But without using pesticides, or by using wrong pesticides, the plants get diseases, and there are also diseases in the soil.

4.4.8 Soil quality

The bad quality of the soil is also a problem in Santa Cruz. Locals talk about soil diseases because diseases from the trees and plants are transmitted to the soil and that there, therefore, is the need to use fertilizers and pesticides correctly. Pesticides on the other hand, are seen as dangerous for the farmers, and not good for people. According to the World Health

Organization (2020), pesticides may be toxic. The soil diseases are seen in relation to lack of natural rain, and bad water quality, by the respondents.

“Jeyson” (28) is head of a household with 7 adults and children. He carries out: “The ground [in Rocha Lama] is too tired. If any help from the government, they should take all the plants away and let the ground rest for a few years. But we don’t have the opportunity, we don’t have the option, because if we don’t work, they have nothing to eat. … Because it [the plantation] is more than 100 years.”

To remove all the plants and let the ground rest is seen as one way to adapt by “Jeyson”. But to manage this economic support to the farmers is needed, while it is being done.

4.4.9 Economic support, other support

Economic support is requested for various adaptation strategies. There is the need for fridges or covers to keep the products cool so the farmers can sell the fruits and vegetables later instead of throwing them away. Support for animal food is also needed.

Support to plant new plants or products more resistant to climatic changes is also seen as a useful way of adaptation.

4.4.10 Solar panels

Solar panels were seen as an adaptation to be used, for example, to pump water from the wells. During the fieldwork, water was pumped from the wells by the use of diesel motors in Rocha Lama. Diesel is expensive in use, and it took more and more diesel to pump the water as the water level in the well were sinking.

4.4.11 Religious beliefs

Religious beliefs are common amongst the locals in Cabo Verde. During the study, some of the respondents expressed religious beliefs connected to climate change and adaptation. They refer to God and to the Bible, both to explain and seek help for the changing climate.

"Nhu Dimingo", a 76-year-old farmer explained climate change the following way:

> "Normally the climate change, you can see it, a lot of people can feel it. … One of the reasons the climate change is because … God punish some people. Because people are not friendly anymore. That's why it's like a punish they get from God. Long times ago was more vegetables, more stuff, because people were more friendly. And then it is a lot of sun, too much sun, more than expected, it's little rain. The main thrust is that God has a punish for the people at the moment."

Also, two respondents by the age of 36 and 40 referred to help from God when they were asked for preferred adaptation in relation to climate change. During one of the interviews, locals were looking up in the Bible and referring to a part that they connected to climate change.

This shows that the local people may perceive climate change as a religious, and in this respect sometimes a local problem. Religious beliefs may lead the locals to seek solutions locally (for example behave better towards their neighbours) or to pray for help from God.

4.5 Sustainability and maintenance of the adaptation systems

When asked about the sustainability and maintenance of the adaptation systems, most of the respondents express satisfaction with it. Especially in Rocha Lama, the adaptation systems seem to be maintained well. Locals tell that they get help from, and share knowledge with, neighbours or the farmers' group.

"Tote" (31) explains: "Especially the drip-irrigation system … in the beginning people need to know, and then we help. We are neighbours and can help them."

There are, however, challenges with pesticides that do not work and expensive systems. During the hurricane Fred in 2015, some of the adaptation systems were destroyed and lost, but the farmers worked together, both to finance and reconstruct things. Hurricanes have, however, been very rare in Cabo Verde.

In Achada Fazenda and Achada Colaço, locals express more challenges. Although some locals there are satisfied, others explain that there would be more sustainability of the adaptation systems if there was more water. Farmers spend much money and pesticides before they find the correct pesticide to use. Locals also explain that despite help from the government to

farmers with drip irrigation, some do not use it well and still use much water. Especially the elderly have a different mentality, one respondent told me.

The local women from Pedra Badejo mostly express satisfaction with sustainability and maintenance of the adaptation systems and that it is "getting better". But pesticides are a challenge also there.

4.6 Positive and negative sides of adaptation and differences between groups/people

It is relevant to look at both negative and positive sides of adaptation towards climate change in Santa Cruz.

Among the respondents, they mostly expressed satisfaction with the adaptation process, both women and men. It is seen necessary since natural forms for agriculture are not possible any longer, amongst other things because of climate change related problems. Negative aspects are often connected to plant diseases because of pesticides that do not work and health problems with pesticides. There furthermore is a lack of knowledge of which pesticides to use. Adaptation, such as pesticides and drip-irrigation, is also very expensive for the people interviewed.

Some express that they wish that agriculture could be natural without climate change adaptation, as an ideal situation.

4.6.1 Gains from adaptation

The respondents were asked if they had any gain from adaptation, or if they knew about groups or people that had gained from adaptation. 18 of 26 respondents stated that they have had some gains of adaptation towards climate change.

Many locals express the advantage with the use of drip irrigation. It is seen as positive by the locals and there are many positive feedbacks. Drip irrigation saves water since the water goes straight to the plant. Hence, it requires less of the farmers' time, it gives higher yields with more produce, and it requires much less use of diesel since less water needs to be pumped from the wells. Farmers that have drip irrigation supported by the government gain more. Some take a loan from the bank to afford drip irrigation and this requires sufficient yield to be advantageous.

Picture 4:7 Tomatoes harvested from drip irrigation plantation. Rocha Lama, Cabo Verde

Photo: Larsen, L. (2019)

Both men and women state that pesticides have a positive effect. It works if one knows which pesticide to use on the different plants and may give gains in form of higher yields and avoidance of plant diseases. Knowledge about pesticides increases the gain of food when farmers know which pesticides to use on different plants at different seasons.

Knowledge about which products to plant at which time also give higher yields, and by knowing when to plant vegetables like carrots, the yields get higher. This also helps to avoid plant diseases and losses.

People with more money have better conditions and better lives. They can invest in adaptation and technology, like pesticides, drip irrigation, fertilizers, et cetera, and get higher yields.

There is a village with new syste4s, respondents told me. They have drip irrigation and good conditions there.

Closer to the mountains there are less plant diseases and farmers there have more yields of for example papayas.

Close to Ribeira Seca they have more access to water from a water dam, but in Rocha Lama people are still waiting to get a dam and there is less water.

People with access to free water (like in Rocha Lama), have less agricultural expenses than those who must pay for water. However, they still need to pay for the motor to pump water from wells, and for diesel.

"Toni", a 59-year-old man who is working in the public sector in addition to farming in Rocha Lama, says: "For sure, other people have more money/condition, have a better life … There are some people here; the government helped them. The people that have more use to receive more. And we don't understand … people complain about it. I have to go to the bank to get money to organize my life… because it is not easy sometimes … And the bank gives us some time, 3 years to pay back." Lisa: "What is the interest rate now in Cabo Verde?" "Toni": "It is around 20 % for 3 years."

When talking with the locals about gains from adaptation towards climate change, the answers tell us that the available adaptation is not necessarily how they would prefer it. "Denilson" a 22-year-old respondent, is helping his brother with agriculture. He explains that adaptation helps, but that he would prefer agriculture without adaptation: "Adaptation helps. It is not something we want, you know. We just accept it. We don't want it, for sure. We want something like in the beginning, like natural stuff, without chemicals; raining."

4.6.2 Negative consequences of adaptation

The respondents were asked if they had any negative consequences from adaptation or if they knew about groups or people that had negative consequences from adaptation. 24 of 26 respondents express that adaptation towards climate change has had negative consequences for them.

Negative sides of adaptation are connected to costs and expenses. Pesticides and drip-irrigation are very expensive for farmers. Sometimes they lose a lot of vegetables and fruit due to plant diseases. Lack of knowledge of which pesticides to use for different plants, and time of the year, results in plant diseases and losses. People thereby spend a lot of money on pesticides, and sometimes it does not work. Also, the lack of knowledge of when to plant the different products in a changing climate lead to losses.

Picture 4:8 Pine nut tree with disease observed at Rocha Lama, Cabo Verde.
Photo: Larsen, L. (2019)

The need for use of pesticides was expressed as the major negative side of adaptation related to climate change, by the respondents. The pesticides are dangerous for people to use (WHO, 2020), and it is often the men that spread the pesticides to the plants while using protection, as it is seen as too dangerous for female farmers to do it. Locals were worried because pesticides generally are not good for people's health (WHO, 2020). But to make plants grow there is need for the use of pesticides, both for the seeds to grow and for the plants to give vegetables/fruits, the respondents told me. One of the farmers spends 10 euros per day on pesticides.

Especially in the research area, there are many plant diseases leading to problems with "everything"; papayas, beans, maize, bananas, mandioca and cabbage. Although there are less diseases closer to the mountains according to locals.

We travelled further up in Rocha Lama and met “Daniela” a 22- year-old who just has finished university. She does not work with agriculture, but expresses concern about the cost of adaptation in Rocha Lama. When we interviewed her, she was preparing papayas, which was a rare sight due to the papaya plant disease we witnessed: “People use to spend a lot of money, because they buy stuff. But sometimes they can see something good, with the things they bought. But it really cost money”.

Respondents tell that they need governmental help to bear the cost of adaptation. Governmental help has been given to some people, but not to others, according to respondents. The farmers that have not received support from the government for example for drip irrigation, may not afford it themselves.

“Dulcina” (40), told me that: “The poor don’t have the money for the medicine [pesticide]. The poor always go down. We see people have a better life”. “We need help. Some people are poor and need money to buy pesticides.” Lisa: “It is too expensive?” “Dulcina”: “Yes, I don’t have money.”

Some are waiting for a water dam (“barragem”) in their area and do not have access to water right now. While people in some locations need to pay for water, others do not have to pay for it. Not all people can afford to pay for the water for agriculture.

Fertilizers, which there is need for, also have expenses. It furthermore can affect the plants and soil negatively if the farmer does not use it correctly.

The local farmers explain that there is the need for more knowledge of how to use these pesticides and fertilizers, and many of them had lost all their papaya, manioc and/or other fruits and vegetables because of diseases and use of pesticides that did not work. And if they use fertilizers incorrectly, they for example risk burning the plants.

“Denilson” explains that “Especially on this side [Rocha Lama] we can see the negative impact. Because, when we put the fertilizer in the ground, if we don’t take care very well, sometimes the plants burn, and then we can lose our plants. It is something that we use to see.” Lisa: “So there is maybe some education needed … ?” “Denilson”: “The best way to organize our stuff is education. Be educated by the government or something. We need it.”

Picture 4:9 Cattle are held also because of need for fertilization. Rocha Lama, Cabo Verde.

Photo: Larsen, L (2019)

"Lenira" (43) is not satisfied with the pesticides. "Some days ago, I grew cabbage, and I put pesticides on it, but still the insects ate it. It is very hard now … It is really hard … I have papaya trees, but all died, even with the pesticides. They are white … People have no idea of which kind of pesticides to put on them." "Aline" (38) did not gain from the adaptation, either: "I didn't find a solution. All my papayas, 200 papaya trees died", she tells. These stories show how farmers spend money on adaptation, but still lose their vegetables and fruits.

Adaptation is not always enough to help the locals coping with the impacts of climate change. When "Dulcina" (40) is asked about adaptation, she replies: "We almost give up. It's not other solutions."

4.7 Are the locals' views being heard?

In the sections 4.7.1-4.7.5 we will take a closer look at how the local respondents in Santa Cruz answered when being asked if they are being heard in a democratic way.

4.7.1 Sharing ideas are mostly positive

Most of the locals answered that they share ideas with each other locally and can advise and learn from each other and work together. Where there is a farmers group this seems especially positive, for those who are part of it.

"Edmilson", (31) told me: "About climate change, we listen to each other, to share advice. Especially the young that work here [in Rocha Lama] share ideas and have a different mentality. The young have more access to the internet - to know about some things that happen, with climate change they share ideas … it's more easy to understand."

4.7.2 Difficulties with sharing ideas and agreeing

It is not always easy to share ideas, the locals explain. Some of the respondents conclude that they are not sharing ideas with others. "Tote" (31) states: "I am not used to share ideas. We do not use to receive…like the guys that really know how to do it ... I didn't see the government in this area [Rocha Lama]."

"People do not agree 100 percent with each other regarding adaptation", says "Denilson" (22). "… People do things by themselves. People don't do things together. It is 50/50, and when people do not work together it is going to be trouble."

"Nhu Dimingo", who is 76 years old and working in Rocha Lama is amongst the older generation in Rocha Lama. He tells me: "Especially the young people do not want to listen to advice that I have."

4.7.3 A farmers group in Rocha Lama

"Zeca", a 62-year-old farmer, that also works with animals and grogue (sugar cane spirit) production in Rocha Lama, tells me: "Normally we create an association, where people that we know work together." Lisa: "So there is a farmers' association?" "Zeca": There's a group … not everyone is involved …" Lisa: "What is the name of the association?" "Zeca": "Just "Amigos" ["Friends"] … The group is growing."

4.7.4 The government

While some locals feel seen and heard by the government, this is not the case for all of the locals.

"Rosinha", is a 32-year-old banana seller, who works with mixed agriculture. We meet her by the plantation, busy loading bananas in the car: "We use to share ideas with our colleagues. We think that we have advice to give the government, but it is not easy." Lisa: "So you want to give advice to the government, but do not have the opportunity?" "Rosinha": "No, we do not have the opportunity."

Farmers explain that there have been promises from the government about drip irrigation, and they are therefore waiting for it, but not receiving it. Among the respondents "Anilton" (32) is one of few that has drip-irrigation, which he has financed through a bank loan. He has been in many meetings with the local government. "Anilton" tells me that: "I have been in meeting with the government, and they wish that everybody has drip-irrigation systems. Because they will help them with money in the bank, because … in the future it will be better, because people will save the water – because we have a big problem with the water. So, it was one of the projects from the government." Lisa: "So you were in a meeting with the government?" "Anilton": "Yes, I have been in a lot of meetings with them." Lisa: "Is it with the farmers' organisation?" "Anilton": "They invite everybody to go, but not everybody wants."

Some of the locals tell that the government do not come and see and listen to them. Like "Nhu Dimingo" tells: "I don't feel that the government came here to see us or to listen to us. … The government use to help somebody who does not need it - but some that really need it, they don't use to help."

"Titina", is a 43-year-old woman, who works in mixed agriculture in Rocha Lama and has 10 people in the household. She tells me that they do not trust the government, as they have not received what they are promised. "It is not easy to get drip-irrigation, because it is expensive. And then, this is a thing everybody wants and expects. …They say they help only on the television. The government and politics say they help. But we didn't see anything… it didn't happen. And then people expect it…because they already know it is a good system, it is the best system they could have."

"Titina" continues: "We want things to happen … No one is helping …We haven't received any governmental help. … We received a lot of promises. Because this is the best agricultural land in the country, the government always like to come here. Especially during election times. But people here don't trust them anymore, we don't vote anymore. We don't believe in them. We have to fight for ourselves. … They only gave every family here 5-kilo black rice one time."

4.7.5 International community

Amongst the respondents, not much was heard about the international community. Except "Titinas'" indirect statement "We want things to happen. … No one is helping", and other locals expressed wishes for projects and assistance in the area. There were not spoken about any international or donor projects in the area, and it is not known to have been any international organisations involved in adaptation related to climate change in the research areas. Locals did not mention the international community directly either, but focused more on the government and local neighbourhood and agricultural area.

4.8 Local views of possibilities to secure a living in Santa Cruz

When asking locals about how they find the possibilities to secure a living in the research area in Santa Cruz, most of the men and women tell that they have difficulties, or that they "survive". Three of the men say that they manage to live there. All of the women state that it is difficult. It is "a fight", both some men and women say.

"Livina", is 34 and she has almost finished university. We meet her in the Achada Fazenda/Achada Colaço area. She does not find it possible to secure a living in her area: "At this time no. There is no water. It's not possible". Many of the women tell that it is very difficult, that they do not live well, or that they need help from the government but do not receive it. "Shepa" (60) talks with us while she is doing her job; preparing food for animals: "I survive, but do not have a good life… just survive".

"Toni" (59) tell that he finds it impossible to secure a living in Rocha Lama with just agriculture. It does not give enough income for children to go to school. He has had another job in addition for over 20 years. "I go to work in the morning first [in the public sector], and then to the agricultural field after. It is a hard life."

When we ask "Isaac" (19) about possibilities for securing a living in Rocha Lama, he replies: "It is a fight… Not good."

4.9 Limitations

Since the researcher does not have an agricultural background, some of the details of the agricultural related answers may not be fully understood, due to lack of insight in the details of the agricultural field. Some of the details may also not be fully understood since the researcher has a background from Europe, never has lived in Cabo Verde, and therefore did not have any deep local knowledge of aspects such as the local culture, of local climate change impacts, and of local adaptation, prior to the research. This may reduce the quality of the research to some extent. On the other side, it can be an advantage to see the local situation from the outside, to be able to explain local climate change impacts and adaptation in a more international context.

The need to use an interpreter between Cabo Verdean Creole and English may have caused some of the questions for the respondents, and answers from the respondents, not being fully and/or accurately interpreted. The interpreters' local knowledge strengthened the research in

many ways, although his non-academic background reduced the quality of the research in other ways.

Answers were sometimes generalised by the interpreter or respondent, also when the question was directed only to the respondent: "People here think…". In the research it is assumed that the respondent answered on behalf of her-/himself, and that the generalisation happened during the translation of the respondents' answer by the interpreter. However, it could also be that some respondents sometimes generalised some of their answers, or that they answered on behalf of the view of others and not their own.

The question about being heard democratically, were often further explained as "exchanging ideas" by the interpreter. Sometimes the respondents answered about exchanging ideas with their neighbours, and colleagues, and not in a political light.

Many of the questions also became asked in a "helping" way by the interpreter, since the local interpreter often added some own knowledge or examples, and sometimes assumptions, like giving the respondents examples of answers (for example by adding "Like less rain, more sun" when asking about experienced climate change impacts). The questions then became leading, although this was not the researcher's initial intention (Bryman, p. 471). Adding some own knowledge and examples might however have been useful in some of the situations where the respondents were unsure of the meaning of a question, for them to be able to understand the meaning better so that they could give an answer to it. As academic language and terms (like adaptation) can be difficult to comprehend, and as more than half of the respondents only had primary education between 1st and 6th class. Clarification, however, not seemed needed in all situations.

Women and men often had different roles, and therefore ended up being interviewed at different locations:

Among the male respondents, 12 of them were interviewed in the irrigated agricultural field in Rocha Lama with access to water. One of the men was interviewed in the village of Achada Fazenda.

Three women were interviewed in the agricultural field in Rocha Lama, but only two of these had access to land there. To reach out to more women, four female respondents were interviewed in the village of Achada Fazenda. Further six of the female respondents were living

and/or working in the Pedra Badejo district in Santa Cruz and were interviewed while working at markets in Praia selling fruits and/or vegetables, as this was common amongst women.

There may be differences according to the respondents' different roles that were related to gender, as there are fewer women with access to irrigated agricultural fields than men among the respondents. This, however, seemed to reflect the gender roles in Santa Cruz, as were observed during the research.

There is a lack of/little representation from men without access to irrigated land, and lack of water for agriculture, in this research. Marginalised men's views of climate change and adaptation are important to listen to (Cornwall, 2003, p. 1137). Especially since many development projects in Cabo Verde, like the Picos and Engenhos Watershed Management project in Santiago, has focused especially on women and less on men (CGTN Africa, 2016; AFDB, 2018; Governo de Cabo Verde, 2018, p. 59). Also, the lesbian, gay, bisexual, and transgender (LGBT) community is important to include in empowerment and development work as well to avoid marginalization of any group (Cornwall, 2003; UN Women, 2018).

The quality of the data may be affected of respondents getting examples of answers "served" in semi-structured interviews with the use of a local interpreter between English and Crioulo, and thereby also affect the local viewpoints, and weaken the further analysis to some extent. Still, my impression is that the local viewpoints are reflected in a realistic way in the research, bearing in mind that they were "helped on the way" by the local interpreter in a leading way, but free to answer as they wished. This weakens the quality of the findings and analysis to some extent, but it is thought that the research still gives a very good description and analysis of local viewpoints of climate change and adaptation.

The analysis does not include any formal institutions' or governments' perspectives of to which extent local viewpoints are being seen and heard by them, in relation to climate change adaptation. Some of the respondents were by coincidence part of an informal farmers group but were interviewed independent of being part of the farmers group. The research and analysis are therefore based on to which extent the locals themselves experience that their viewpoints are being seen and heard (both in the local neighbourhood, informal institutions and by formal institutions).

5. ANALYSIS

The previous chapter presented the empirical findings of the research related to climate change adaptation in Santa Cruz on Santiago Island, Cabo Verde. This chapter presents the analysis of the findings, seen in connection with secondary literature and the theoretical framework.

5.1 Analysis of climate change impacts and locals' experiences

It is interesting to look at how the locals' experienced climate change impacts, taking current research to account. The experiences many of the respondents, like "Lenira" (43), "Dulcina" (40) and "Edmilson" (31) told me about; less rainfall and reduction of yields of for example bananas and potatoes, were very likely to occur. Climatic models during the NAPA assessment for the period 2008-2012 showed that climate-related disruptions in Cabo Verde may lead to shortened rainy seasons in the following decades, with its immediate impact on livelihood and agriculture (World Bank, 2019a, para. 1). That there had been three years with little rainfall in Santa Cruz is in line with the climatic models (World Weather Online, 2020; World Bank, 2020; FAO, 2018a).

Many respondents also had noted a warmer climate, which corresponds with the increase of average temperature in Cabo Verde by 0.6°C from 1960 to 2006, that has continued, and is predicted to continue further in the following decades (World Bank, 2020, "Temperature", para. 1; McSweeney et al., 2012, p. 1).

Men more often than women reported about less water and about plant diseases as climate change impacts. This might be since more men than women in this research worked in the agricultural field, and because women more often did not have access to water or irrigated land at all. One of the women reported that there were fewer jobs because of the lack of rain.

5.2 Analysis of preferred and experienced adaptation

5.2.1 Experienced adaptation

The experienced adaptation strategy is mainly water wells and water-related adaptation. Irrigation systems have been constructed. Drip irrigation "gota a gota" is an adaptation that all of the respondents know about, but few have it. To afford it might require taking up a loan for those who have the possibility.

Also, the use of pesticides and fertilizers is an adaptation strategy. Pesticides are used by most, if not all, of the farmers interviewed to avoid plant diseases. Yet, locals told me that the fruits and vegetables could become misshaped by the use of pesticides, and that it also has health risks (WHO, 2020). Fertilizers are usually necessary to get a healthy soil that gives sufficient yields, but it may also affect the plants, soil, humans and animals negatively (FAO, 2019).

Due to the warmer climate farmers plant more bananas now, while they grew more manioc before. Change of plant products is an adaptation strategy that has been initiated.

The impression is that adaptation in Santa Cruz is limited because of its cost. Most people cannot afford to adapt additionally. Locals do not receive enough assistance to be able to adapt more either. Furthermore, many locals do not have access to sufficient knowledge platforms or possibilities for education to take full advantage of adaptation in a changing environment.

5.2.2 Gender and experienced adaptation

Both women and men experienced adaptation related to pesticides and water. But experienced adaptation has some differences among the women and men in this research. Women more often experienced that there was no more water, or rarely water, in the adapted dams/reservoirs.

For some of the female respondents it would not be possible to use drip irrigation even if they had it, because of too little access to water. The research also revealed that the women had less access to the irrigated land in Rocha Lama.

It seems that women face greater challenges related to adaptation and access to irrigated land than men in Santa Cruz. The study of Corral et al. (2017) addresses similar remaining challenges other places in Santiago Island, with lack of water, and that women have less access than men to irrigated land.

In both colonial and post-colonial Cabo Verde, women's and men's roles have been hierarchical (CGTN Africa, 2016). Sudarkasa (1986) point to how colonisation and capitalism contributed to this in Western Africa.

5.2.3 Preferred adaptation

Some of the locals referred to natural agriculture as their preferred situation, and some expressed adaptation as something negative that they had to make use of. This shows adaptation due to climate change is not always viewed in positive terms by locals, in line with what Taylor (2014) also points out. For many, it is an expensive necessity, and many of the respondents

were bearing the cost of adaptation like drip irrigation and pesticides themselves. Many locals ask for increased governmental assistance in various ways, and this seems to be highly needed, as it did not seem to reach sufficiently out to the locals. This study did not observe any external assistance from international organisations in the research area either.

Water is a major concern for many, and more water for agriculture and improved water quality (for example less saline water), is some of the most preferred adaptation strategies by locals. Preventing water in Santa Cruz to go straight to the sea could be done by constructing a reservoir and water distribution system (UNDP, 2015). Also, ways to save water usage is seen as important, for instance by the use of drip irrigation ("gota a gota"). Many farmers express that it is too expensive for them to take loans for drip irrigation, but the respondents would like to have the system and are hoping for help to get it.

Another adaptation that is preferred is economic assistance for example with pesticides, animal food, covers and fridges. It again shows that the economy is a challenge for the locals.

Solar panels were mentioned as a preferred adaptation by respondents instead of using diesel to pump water from wells, and it can be used to desalinate water as well (Karaghouli & Kazmerski, 2013).

For the locals in the research area in Santa Cruz to be able to adapt as they prefer, there is clearly an economic challenge. Many of the respondents did not have sufficient means to be able to bear the cost of such adaptation and are dependent on help to achieve this. Also, there was a lack of sufficient information channels or education related to adaptation in a changing environment.

These findings include what Eriksen et al. (2015, p. 527) call local "knowledges".

5.2.4 Gender and preferred adaptation

The women expressed more need for water than men, as they often did not have it. This was especially the case in the Achada Fazenda/Achada Colaço area. They would need water before they could use drip irrigation. Men we interviewed had more access to water, and more often expressed a need for drip irrigation. Both women and men saw the need for governmental help and projects. Men requested education and women requested jobs and opportunities.

5.3 Analysis of sustainability and maintenance of the adaptation systems

The respondents found that there was a high sustainability of the irrigation systems including the drip-irrigation systems.

Especially the research in Rocha Lama showed that the farmers usually cooperate and work very well together with maintenance of adaptation systems, something the reconstruction work after hurricane Fred is an example of. The farmers both seem to have knowledge of the irrigation systems and how to maintain them well. Pesticide systems were usually also sustainable and maintained well, according to respondents.

Haagsma's (1995) study from Santo Antão Island and the study by Corral et al. (2017) in Santiago Island show the importance of farmers' participation in adaptation work also when it is projected by the government. When farmers themselves feel ownership to and know how to maintain their systems, this can help ensure sustainability of the adaptation systems, making them last over longer periods of time (Haagsma, 1995; Corral et al., 2017). In Santa Cruz, it seems important to ensure that farmers continue to feel ownership of and have knowledge of the adaptation systems, also if projected by the government or organisations, to maintain them in a sustainable way.

5.4 Analysis of correspondence between preferred and experienced adaption

It was considered highly relevant to analyse local preferences related to eventual adaptation towards climate change, seen in relation to which extent it corresponded with experienced adaptation in Santa Cruz.

This with Taylor's (2014) theory in mind, that tells about how one should be very careful with thoughts of adaptation, and his concern that adaptation has become self-evident. And as well Eriksen et al.'s (2015, p. 525) conceptualization of adaptation "as part and parcel" of broader patterns of social change. They refer to O'Brien (2012) who says that "adaptation needs to be tied to the everyday livelihood activities and ambitions of individuals and groups in society" (Eriksen et al., 2015, pp. 525-526). Instead of being 'recipients of adaptation', people should be "active agents in shaping their destinies" (Eriksen et al., 2015, p. 526). It is very important to include local knowledge in climate change adaptation, together with knowledge from governmental and international institutions, according to Eriksen et al. (p. 526).

5.4.1 Do local wishes correspond with the ongoing adaptation?

When looking at the ongoing adaptation strategies and locals' preferred adaptation, there is correspondence when it comes to increased water resources, increased water quality, and increased access to water.

The ongoing adaptation related to pesticides and fertilizers, however, is not something that locals mention when asked about their preferred adaptation. Still, the use of pesticides and fertilizers is seen as an absolute necessity by locals and sometimes mentioned as a good necessity. Some have negative opinions about pesticides, especially since they are not always working, and are expensive and unhealthy (WHO, 2020). Use of pesticides and fertilizers may have both positive and negative impacts (FAO, 2019; FAO, 2016b; FAO; 2011).

Drip irrigation is wanted and expected by many locals, and it is an ongoing adaptation in Santa Cruz. But the respondents saw little of it where they were living or working, and drip irrigation is expensive for the farmers that may need to take loans to finance it, if there is no help from the government or donors. There was no observed use of drip irrigation or sprinkler irrigation at the banana-plantation, although this also may be a possibility (FAO, 2020a, "Irrigation methods", para. 1).

The government had reached out well to one of the respondents, but not to others with their drip irrigation project. They seemed to have managed to create a trustful relation to the respondent that cooperated with their project in Rocha Lama. After being in a difficult situation, he ended up taking a loan to buy drip irrigation. Another respondent in Rocha Lama expressed that she did not trust the government anymore and had not received any help with adaptation. She understood that drip irrigation was promised by the government to be given to all farmers and expected to receive it for free. Other respondents that clearly knew about the possibility to get drip irrigation by taking a loan, had decided to wait and see if they could be helped by the government and receive it for free instead. In this case, there were different expectations amongst the respondents, but for all of them it seemed like taking a loan to buy drip irrigation was the last option in case they did not receive it for free.

More governmental help is wanted by both genders, and locals suggest help with projects, jobs and opportunities, economic assistance, agricultural education and knowledge, and more. The respondents had so far not received much help from the government or other instances and requested more visibility from the government. It is important that the government knows the

agricultural field and hears the locals' viewpoints concerning climate change and adaptation. Recent agricultural policies have been helpful in three water basins at other locations of Santiago Island, according to Corral et al. (2017). The findings of this research suggest that policies related to climate change and adaptation could be helpful for the locals and the environment in Santa Cruz.

As seen in Rocha Lama, where there was a change to more banana production and less mandioca, more of this form of adaptation with more resistant plants was requested by locals, especially to reduce the experienced plant diseases. Also, soil rehabilitation was requested, with economic support for farmers during the process. In relation to this, it is relevant to look at the studies of Baptista (2013) in Ribeira Seca in Santa Cruz, which is close to Rocha Lama, that found it possible that yields could be increased by the use of technology that might be too expensive for farmers. Baptista et al. (2015) also found the need for policies related to sustainable land management (SLM) practices, to reduce land degradation, and achieve optimized soil management that treats soil as a limited and threatened resource.

Furthermore, there is a request for more governmental control of the use of water resources. This is a concern that Baptista et al. (2015) also mentions, where they argue that strengthened policies are needed for sustainable water management. As well Bosa (2015) describes how water management in Cabo Verde has possibilities for improvement.

The adaptation with food for animals and cover is ongoing and still requested. Farmers also keep animals due to the need for fertilization.

Solar panels were seen as an adaptation method to be used in relation to climate change. There is now use of diesel to pump water, and no ongoing adaptation related to solar panels was mentioned by locals. Diesel is a fossil fuel, which is not environmentally sustainable and expensive to use. Solar panels are a renewable energy source that could be considered for use in Santa Cruz to pump water from the wells, and in relation to desalination and improvement of water quality (Karaghouli & Kazmerski, 2013; Kabir et al., 2018). Seen in a long-term perspective, solar energy could also be less expensive in use, although the initial installation costs often are high, according to Kabir et al.

Research shows that the respondents in Santa Cruz request more, and often other forms for adaptation than the adaptation they experience in the area. There is especially a request for more governmental help, more water, better water quality, projects, economic assistance, jobs and

opportunities, education, more drip irrigation and solar panels. Here there is local knowledge that it is important that the government and international institutions includes and listens to in their work with adaptation (Eriksen et al., 2015, p. 526).

Many of the respondents explain that natural agriculture with rainfall is their preferred situation and one respondent states that adaptation is not wanted. But since there is not much rainfall in Santa Cruz, adaptation is needed and accepted to be able to have agricultural activity, according to respondents. There is especially a need for adaptation related to water and adaptation to avoid plant diseases. Without adaptation, agriculture might become a very precarious, perhaps one time a year activity in Santa Cruz. Plants could not grow without adaptation, according to locals.

In Cabo Verde wage-earning is key to achieve food security ("Huss-Ashmore 1989; Sen 1981; Shipton 1990" as cited in Rodrigues 2008). But not to invest in agriculture with a solid program, and depend only on wage earnings from the service sector, has shown to be unsafe in Sub-Saharan Africa ("Huss-Ashmore & Thomas, 1988; Huss-Ashmore 1989" as cited in Rodrigues 2008.)

Like Taylor (2014) points out there is a capitalistic side of adaptation in terms of who bears the cost and who benefits when adapting due to climate change. For the locals in the research area in Santa Cruz to be able to adapt as they prefer, there is clearly an economic challenge. Many of the respondents did not have sufficient means to be able to bear the cost of such adaptation and are dependent on help to achieve this. The only way for many of the farmers to adapt may be to take loans, with the risk that follows if yields are not sufficient and they are not able to pay back. Only if the yields are sufficient, the farmer will be able to benefit from adapting under their difficult circumstances.

> "…marginalisation of questions of power within the discourse … steadfastly opens the political terrain for technocratic colonisation."
>
> (Taylor, 2014, p. 65)

To avoid the technocratic colonisation that Taylor warns about, it is necessary to listen to local's views and knowledge of adaptation.

5.4.2 Gender and correspondence between preferred and ongoing adaptation

There is an expressed need for more water by women in all the research locations. The women responded that they experience water-related adaptation, but often not sufficiently. Governmental help is wanted, but often not experienced much by the women. Economic support, projects, jobs and opportunities is wanted by the women, but not experienced. Solar panels are wanted, but none of them have it. Drip irrigation is wanted by women that have access to water, but they do not have it. One of the women responded that she expects to receive it from the government according to promises from them.

The men responded that governmental help is wanted, but seldom experienced, except perhaps with fertilisation/pesticides and help with bank loans. Water-related adaptation and drip irrigation are also wanted by men. Many men had access to water, but most of the respondents did not have drip irrigation. Education and knowledge are needed, and only one of the respondents had agricultural education. Usually, the locals depended on learning from their neighbours. Solar panels are wanted, but none of them have it. Economic support is wanted, but not received except bank loans.

5.4.3 Local religious beliefs

Ingold's (2000) describes considerable differences regarding how humans in different societies perceive and relate to the environment. Also, Eriksen et. al (2015) set out that knowledge about climate change has different values in different cultures and geographic locations.

Findings in this research show that some of the local people in Santa Cruz perceive climate change in religious terms, and in this respect sometimes as a local problem. This makes it probable that religious beliefs may lead the locals to seek solutions locally or in religious ways (for example, behave better towards their neighbours, seek information about climate change in the Bible and wait for God to bring rain). Locals may see the responsibility as local or within religious frames, which also may affect their adaptation. They may therefore not request help from donors. As also described in part 4.4.11 of chapter 4, the research shows that some locals have a different way of seeing climate change and relate to adaptation than the scientific way of seeing climate change and adaptation.

5.5 Analysis of positive and negative sides of adaptation and differences between groups/people

The interviews were seeking to problematise climate change adaptation by looking at positive and negative sides of it. This comes with Taylor's (2014) theory in mind, which says that one should be very careful with thoughts of adaptation and that it has become self-evident. Processes of adaptation can make a positive change for some people, but be negative to others (Taylor, 2014; Eriksen et al., 2015). The interviews thereby also focused on how people may be differently affected by adaptation in line with these theories.

18 of 26 respondents tell that they have had some gains of adaptation towards climate change, while 24 of 26 respondents express that adaptation towards climate change has had negative consequences for them.

5.5.1 Positive and negative sides of adaptation and differences between groups/people

Drip irrigation is seen as a positive way of adapting by most of the respondents; it is positive in terms of saving water and getting more yield, but the negative side is that it is too expensive for most of them.

Pesticides are seen as both positive and negative by locals. It is positive because it can give higher yields and reduce plant diseases. But it is negative if one does not have knowledge of how or on which plant species to use the different pesticide types, or not have the money to buy it. There are also health risks using pesticides, as they can be toxic to humans (WHO, 2020; FAO, 2008, pp. 1-2). "This is particularly true for poor rural people, who cannot afford to use the less toxic compounds or to own proper application or safety equipment. … A growing number of pests and diseases could lead to higher and even unsafe levels of pesticide residue and veterinary drugs in local food supplies" (FAO, 2008, p. 2). If farmers had a local knowledge channel where they could get information about which pesticide they could use on which plant, this would reduce the use of pesticide, as well as reduce the losses of yields and the health risks (FAO, 2020b).

Pesticides usually contribute to greenhouse gas emissions to a lesser extent, while fertilizers may give larger amounts of greenhouse gas emissions (Hillier et al., 2011; Tubiello et al., 2013). The farmers did not mention use of synthetic fertilizers, only natural fertilizing by manure ("adub") applied to soil, which usually contribute to lesser emissions according to Tubiello et

al. But observation indicated that also mineral or synthetic fertilizers might have been added by an external company and/or the government, and according to Tubiello et al. synthetic fertilizers usually gives higher emissions. According to the Food and Agriculture Organization of the United Nations fertilizers are needed to achieve food security and soil health, and the levels of fertilizer must correspond to the need of the soil and crop for yield to be sustained, and to avoid crop failure or pollution (FAO, n.d.; FAO, 2019). If managed with Sustainable Soil Management (SSM) techniques including fertilizers, soils can store carbon and lead to decreased greenhouse gas emissions in the atmosphere. (FAO, 2016b, p. 2; FAO, 2011, p. 63). Fertilizers may affect the health of humans and animals if not properly used (FAO, 2019).

> "The production of food depends on healthy agricultural systems. These in turn depend on healthy soils."
>
> (FAO, n.d., para. 9)

One challenge with climate change adaptation is that it requires new knowledge. There were differences with regards to knowledge amongst the respondents. Some farmers with the necessary knowledge could be able to plant at the correct time, use pesticide and fertilizer correctly, and get gains of vegetables/fruits. Other farmers need more knowledge, because they can not find the correct time to plant vegetables/fruits, which vegetable/fruit to plant, or the correct pesticide to use anymore. They end up using a lot of money and eventually pesticides, without gaining anything from it. The cost became too high for them.

The locations closer to the mountains had less plant diseases (for example not so many papaya trees affected by plant disease) respondents told me. In the research area, there were problems with "everything", probably because of lower water quality, warmer and drier conditions. In the area of the research, there were also differences in access to water. While respondents in Rocha Lama had access to water, some of the respondents in Achada Fazenda/Achada Colaço and Pedra Badejo told me that their water dam was empty or was not constructed yet.

According to Bosa (2015), there are differences in both access to water and whether people have to pay for water in Cabo Verde. Bosa describes that water management in Cabo Verde may be owned by public or sometimes by private institutions. It can also be owned by informal non-institutional owners. Water may be very unequally distributed and may be difficult for the state to control (Bosa, 2015).

Farmers that had more means and/or resources had more possibilities to keep up with the necessary adaptation by buying pesticides or taking loans for drip irrigation, while the poorest people could not afford it and saw no solution for the future.

The knowledge about positive and negative sides the locals mention, are important to include in adaptation strategies (Eriksen et al., 2015, p. 526). Especially the costs and the knowledge that adaptation requires are important to be aware of, since many farmers do not have access to the necessary capital and / or knowledge to be able to gain from adaptation.

The differences between groups and people related to adaptation on Santiago Island brings the concept of 'subjectivities' into mind, as it sees social inequalities as a possible ground for people to resist domination and question climate change adaptation in alternative ways (Eriksen et al., 2015, p. 528). At the moment there is a lack of what Eriksen et al. frames as power and 'authority' amongst most of the respondents which need to be improved (p. 528).

5.5.2 Gender differences related to positive and negative sides of adaptation?

More men than women tell that they gained from adaptation. More women than men tell that they have *not* gained from adaptation. This is not so surprising when we see that the women in the research had less access to water. If there is not water, it is not possible to gain something by use of for example pesticides or drip irrigation either.

Men express a little more negative consequences from adaptation than women, and this may be because they are the ones that are able to make use of more forms of adaptation.

As we can see, women have fewer gains than men, but men express more negative consequences of adaptation. This may be due to the fact that women often work in the markets selling fruits and vegetables, while men often are working in the agricultural field due to different gendered roles (Suarkasa, 1986).

That women have less access to water than men in Santa Cruz corresponds with the findings in the study by Corral et al. (2017) from other areas of Santiago Island.

5.6 Analysis of to what extent locals feel democratically heard

5.6.1 To what extent do locals feel democratically heard?

Seventeen respondents answered positively when asked if they felt that they were heard in a democratic way, while seven answered negatively to the question.

While many feel heard by the neighbour locals, only a few of the respondents told that they feel seen and heard by the government.

Only in Rocha Lama locals told about an existing farmers group, where local farmers cooperate. But it seems to be a problem that the farmers that are not part of the group do not always feel that it is easy to discuss. As there is expressed different opinions among younger and older farmers as well as differences between women and men, it seems like the group could benefit by having representation of different ages and genders, if not already represented. Rocha Lama is also a large agricultural area, and locals further up told that they are not used to have a group to discuss climate change problems. In Achada Fazenda and Achada Colaço locals told that they talk together about farming and climate change, for example at the same time as they meet and discuss religion. They did not tell about a farmers group.

One of the respondents in Rocha Lama has been in meetings with the government and could tell that they want everyone to come to the meetings, and that everyone gets drip-irrigation, but that the locals do not want to go. The impression when talking with respondents, is that they wish that the government comes to see how it is in the agricultural field, to get an understanding of how climate change affects the agricultural work and their situation related to adaptation there.

Among the respondents, some of them are more heard than others in the local community. To be part of the farmers' group, or go to meetings with the local government, seem to be of high importance for feeling heard and seen. It is a good development that the farmers groups in Rocha Lama are growing, hopefully for both genders and various age groups. Other locations would gain from organising in groups as well. It seems that the government should do far more for the locals to feel heard and seen by them. The same applies to the international community, which were not mentioned by any of the locals. As climate change is an international responsibility, aid for adaptation because of climate change impacts should preferably be visible for locals.

To go and see the agricultural fields and listen to local viewpoints, is important to increase understanding of climate change impacts and of what adaptation that eventually is needed, for all actors that work with climate change adaptation.

It is crucial to include local knowledge of climate change adaptation, together with knowledge from governmental and international institutions (Eriksen, et. al., 2015, p. 526). This makes it possible to achieve adaptation that fits with the local environment. Various groups of people should be included to avoid the inequalities and hierarchic structures that Eriksen et al. warns about.

There is clearly a lack of power and 'authority' amongst most of the respondents (Eriksen et al., 2015, p. 528). To increase the cooperation between the government and the locals in need of adaptation, there is a need for improvement in Santa Cruz, since many respondents express that they are not sufficiently seen and heard by the government. The government could make a greater effort to visit the agricultural fields and talk with and listen to the people. The locals could be more aware that they are welcome to meetings with the government and think of how it could be useful for them to express their knowledge (Eriksen et al., 2015, pp. 526-529). Locals could benefit from creating larger and more organised farmers organisations (Corral et al., 2017) and engage themselves more in the meetings with the government. When increasing and strengthening cooperation between the state and the locals, it could lead to much higher gains from climate change adaptation in a long-term perspective (Ostrom, 1996; Evans, 1996a; Larsen, 2018a).

It is important to keep a democratic adaptation process, where the politicians and development institutions listen to the local people, and bear in mind the expenses that the locals struggle with in relation to adaptation (Eriksen et al., p. 529; Taylor, 2014, p. 111).

5.6.2 Are women and men being equally heard?

Eight of the women and nine of the men answered positively when asked if they felt heard in a democratic way. Four women and three men answered negatively to the question.

The women expressed more difficulties with being seen and heard by the government than the men. Also, some women are not aware of farmers groups to discuss climate change problems. None of the women told that they were part of a farmers group. In Achada Fazenda/Achada

Colaço it was said by a woman that people meet and talk together about farming and climate change, for instance when they meet and discuss religion.

In Rocha Lama, one of the male respondents have been in meetings with the government, and men told about a farmers group where they help each other. The farmers group seems to be growing, but not everybody is in it. There were men in Rocha Lama that expressed that it is very difficult to discuss with others there, and that they had not seen the government there.

Among the respondents, some of the men and some of the women are more heard than others locally, but the men seem to be more organised and have more contact with the government. It seems that women could participate more in farmers groups and meetings with the government to express their knowledge (Eriksen et al., 2015, pp. 526-529). However, women told that they met others in religious meetings, where they also learned about agriculture from each other. It is a good development that the farmers group is growing, hopefully for both genders. It seems that the government should do more for the local men and especially the women, to feel heard and seen by them. The same applies to the international community, which neither was mentioned directly by women or men during the research.

Structures like gender are important to be aware of, together with other structures as class and social groups (Cornwall, 2003, p. 1338; Taylor, 2014, p. 73). To seek either more gender equality or more gender neutrality and non-hierarchical structures, like Sudarkasa (1986) found in her studies from indigenous Western Africa where there was equal worth of both women and men, despite having different roles, is a possibility. Cabo Verdean's own perspective when it comes to gender and development, is crucial in this respect (CGTN Africa, 2016; UN Women, 2014; Larsen, 2019).

5.7 Analysis of possibilities to secure a living

5.7.1 How do locals find the possibilities to secure a living in Santa Cruz

Most of the men and women in the research area tell that they have difficulties with securing a living, or that they "survive", and describe it as "a fight", very difficult, and that they do not live well. Their description is supported by statistics by Instituto Nacional de Estatística Cabo Verde (INE, 2018b, p. 60). Even though Santa Cruz is a municipality with large agricultural areas and irrigated plantations, it was the municipality with the highest occurrence of poverty in Cabo Verde per 2015, and 58.9 % of the population were living below the absolute poverty

line (INE, 2018b, p. 60). Amongst the population in Santa Cruz, 27 % were living in extreme poverty. This was the third-highest occurrence of extreme poverty amid the counties in Cabo Verde per 2015 (p. 67). This is reflected by the respondents; some need help but do not receive it.

Statistics alone does, however, not include all aspects of a society, such as informal work, and may have limitations in its accuracy (Charmes & Wieringa, 2003, Chant, 2006). Aspects such as informal economy, agricultural work, as well as domestic, reproductive and care work are not necessarily included in the measures, but also of relevance (Charmes & Wieringa, 2003). In the informal sector in Cabo Verde, 58.8 % of the workers were women, and 41.2 % of them were men in 2015 according to information from INE (2017, p. 53).

Some respondents describe that they find it impossible to secure a living with just agriculture in Santa Cruz. Locals that do not find possibilities to secure a living in Santa Cruz, will presumably look for opportunities elsewhere. As Åkesson (2008) describes in her research in Cabo Verde, the issue of migration is something that is a part of Cabo Verdeans everyday life.

5.7.2 Gender and possibilities to secure a living

All the female respondents told about difficulties with securing a living in the research area in Santa Cruz, and 10 of the men told about difficulties. Three of the men told that they managed to live there without difficulties. The gender difference between women and men is also seen in statistics of extreme poverty and gender in Santa Cruz municipality per 2015 (INE, 2018b, p. 76). The statistics state that 56.6 % of the extremely poor were women, and 43.4 % were men (INE, 2018b, p. 76). 53.3 % of the poor population in Santa Cruz were women and 46.7 % were men per 2015, according to the statistics by INE. In the informal sector in Cabo Verde, 58.8 % of the workers were women, and 41.2 % of them were men in 2015 according to information from INE (2017, p. 53).

Respondents expressed visible differences in access to irrigated land and water. More men than women had access to irrigated land with better access to water. They had their struggles with plant diseases and loss of yields. There were not observed any male fruit sellers. All the fruit sellers were women, and they often expressed difficulties with securing a living due to hard competition and days without selling any fruit.

Differences in gendered roles seem to create inequality in possibilities to secure a living. There is a need to find a way to ensure more equal earnings for fruit sellers and farmers (Sudarkasa,

1986). More equality could also be sought by making changes in women and men's gendered roles. One example of this is the Picos and Engenhos Watershed Management project where more women got access to irrigated land (AFDB, 2018). It is, however, important to remember the inclusion of both women's and men's interests and perspectives in such projects to avoid further marginalization by any gender (Cornwall, 2003). It is important to have in mind that - because of the strong focus on women in development work in Cabo Verde - men have not been sufficiently included in empowerment and development work (Cornwall, 2003; CGTN Africa, 2016). This has resulted in many men now being increasingly left behind and getting problems (CGTN Africa, 2016; UNODC, n.d.; Larsen, 2019).

Further, it is important to include Cabo Verdean's own perspective when it comes to gender and development since their own view of this previously has not been sufficiently included (UN Women, 2014; Larsen, 2019).

5.8 Climate change is a global responsibility

The overwhelming majority of actively publishing climate scientists agree that the climate change the world experience today is caused by anthropogenic (human-caused) emissions of greenhouse gases (NASA, 2020a, para. 1). The major contributors of the global human-caused climate change come from other countries than Cabo Verde, and it is a problem which is caused globally (Crippa, et al. 2019). According to the European Commission (2016), Cabo Verde has a "negligible" contribution to global warming. But climate change is a considerable threat for Cabo Verde, due to its vulnerable arid landscape in the Sahel region, and as one of the Small Island Developing States (SIDS) (UNEP, 2012). This research has shown how climate change adaptation not always is sufficient, and also may have negative consequences for the locals in Santa Cruz. To reduce further anthropogenic climate change, there is a need for reduction of greenhouse gases globally, and especially in countries with high emissions. There is a need for international assistance for climate change adaptation in Cabo Verde, for the locals' agricultural work for the future.

6. CONCLUSION

6.1 Overview

Climate change impacts experienced by locals in Santa Cruz are many. A warmer climate with higher mean temperatures, more sun and less rainfall, plant diseases, reduction in yields, and less water are some of the changes the locals are living with and are struggling to adapt to.

Yet, climate change adaptation is not always viewed in positive terms by local people (Taylor, 2014), and many locals in Santa Cruz tell that adaptation is an expensive necessity, and that they bear the cost of it themselves.

To some extent, the adaptation strategies in Santa Cruz correspond with local perceptions of what adaptations are needed, like increased water resources, increased water quality and access to water, and governmental assistance. However, locals request more, and often other forms of adaptation, than the adaptation they experience. Especially, there is a request for more assistance from the government or other organisations, more water, better water quality, more drip irrigation, and solar panels. Women most often request water-related adaptation, as they often have less access to water than men. Men often request governmental or other assistance with adaptation. Women and men have different views about what kind of climate change adaptation strategies they find necessary.

Locals do perceive both positive and negative sides of adaptation related to climate change, and there are differences between both groups and people in this respect. Adaptation can lead to less use of water and more yields. While farmers with more means and resources may have possibilities to keep up with the necessary adaptation by buying pesticides or taking loans for drip irrigation, most locals in Santa Cruz tell that they cannot afford this. Especially the costs and the knowledge that adaptation requires are important to be aware of, since many farmers do not have access to the necessary capital and knowledge to be able to gain from adaptation. Women tell that they gain less from adaptation than men. Conversely, men express more negative consequences from adaptation than women. Women often work in the markets selling fruits and vegetables, while men often work in the agricultural field.

Most important, the local knowledge about positive and negative sides of adaptation, along with inequalities between groups and people, is crucial to include and consider in local adaptation strategies in Santa Cruz (Eriksen et al., 2015).

Local knowledge of climate change adaptation needs to be seen together with knowledge from governmental and international institutions (Eriksen et al., 2015). In this way it can be possible to achieve adaptation that fits with the local environment. It is important to include the viewpoints of women, men and various groups of people to avoid inequalities and hierarchical structures, and since there clearly is a need for more power and 'authority' amongst most of the respondents (Eriksen et al., 2016; Cornwall, 2003; Sudarkasa, 1996). When asking to what extent the locals feel that they are heard in a democratic way in the adaptation process, locals express that they are not sufficiently seen and heard by the local government and the international community. There is therefore a need for improvement of the cooperation between the local people, the local government, and the international community in the need of adaptation in Santa Cruz (Eriksen et al., 2015).

Most of the men and women in the research area tell that they have difficulties with securing a living in Santa Cruz. "I just survive", is a common description, when locals tell that they do not live well. Differences in roles seem to create inequalities in securing a living where women often have more difficulties than men. Seeking a neutralised balance is essential here (Sudarkasa, 1996; Cornwall, 2003).

It is important to remember that climate change is a global responsibility (Crippa et al., 2019). An international effort to reduce greenhouse gases especially in countries with high emissions is necessary to reduce climatic change impacts and the need for adaptation.

In Santa Cruz local people struggle with costs and consequences of climate change adaptation without receiving any assistance from the international community.

6.2 This study's contribution

This study contributes with research of some of the locals' own experiences and viewpoints of climate change and adaptation in Santa Cruz, Cabo Verde. The study can be helpful to understand more of the local people's problems and challenges facing climate change, and is important when deciding ways of adapting, with its positive and negative aspects. How locals perceive different forms of adaptation differently is an important factor to consider (Eriksen et al., 2015), as well as local's involvement; both factors are important for the sustainability of a project (Corral et al., 2017). The research has shown that it is important to be aware that while some are improving their livelihood, others may still be falling behind (Eriksen et al., 2015).

The research can also be useful in relation to further studies related to climate change and adaptation in Cabo Verde. According to Eriksen et al. (p. 528), it is a general problem that there are few local studies about climate change and poverty.

6.3 Possibilities for further studies

There are many areas where further studies will be useful. Further studies could be done related to possibilities for increased access to water in Achada Fazenda/Achada Colaço.

There are also possibilities for letting the ground rest in Rocha Lama for improved agricultural productivity and financial support for the people affected, which could be studied further.

It might also be useful to study whether drip irrigation or sprinkler system could be used for bananas, particularly in the Rocha Lama plantation.

Studies of the relation between government, formal/informal institutions and the locals, would be useful to see to which extent different views and local knowledge are taken into account with regard to the power relations in the society (Eriksen et al., 2015).

Lastly, there are possibilities for studies of local views of climate change impacts and adaptation in other locations in Cabo Verde.

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Appendices

Appendix 1: Interview guide used in interviews

1. Have you, or local people that you know of, experienced any climate change impacts? Which ones? (Make sure respondent are aware of the meaning of the term climate change.)

2. Has there been any adaption related to climate change in the area where you live? What kind?

3. What kind of adaption do you find necessary in relation to climate change?

4. To what extent are you satisfied with the adaptation process?

5a. How sustainable has the eventual adaption been (is it still functioning after 5 years)?
b. Are there taken responsibility for maintenance of the adaption system(s)?
c. To what extent has the maintenance of the adaption system(s) been satisfying?

6. To what extent do you feel that you are being heard in a democratic way in regards to your views of adaption towards climate change?

7. Have you gained from any adaptation towards climate change? Which? How?

8. Have any adaptation towards climate change had negative consequences for you? Which? How?

9. Are there any groups/people that you know of that experience negative effects of adaption towards climate change?

10. Are there any groups/people that you know of that experience positive effects of adaption towards climate change?

11a. What is your level of education?
b. What is/are your occupation(s)?
c. What is your age?
d. How many people are there in your household?
e. What are the number, age and gender of the adults and the number and age of children in the household?
f. Who is the head of the household?

12. How do you find the possibilities to secure a living for you in this area?