



# Nature-based solutions as a climate change adaptation strategy

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A study of how Kristianstad Municipality applies nature-based  
solutions in the planning process

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## Abstract

Because of climate change, rising sea levels in Kristianstad Municipality is more urgent than ever. Sea levels around Scania are estimated to rise more than 2,5 meters in 80 years considering that they are currently rising with 3,2 mm per year. This can lead to erosion and more frequent floods, which in turn can alter beach areas and nearby housing. Kristianstad has an excessive risk of being affected by global temperature increases and sea level rise because of the lowland and vicinity to the ocean. The lowest point in Sweden is located in Kristianstad at 2,41 meters below sea level. Kristianstad Municipality has implemented seawalls to prevent disastrous consequences of sea level rise and is currently prevailing in the discussion of biological-based solutions to the matter in two different projects. The first is a EU-funded project called LIFE Coast Adapt, where the city is planning on constructing a natural reef, which aims to prevent coastal erosion and facilitate biodiversity. Furthermore, the second project, dubbed Drömprojektet, is funded by the WWF and municipality and intends to plant eelgrass shoots to improve the environment around the bay area of Hane. Nevertheless, the city's coastal and maritime spatial planning plan and climate adaptation plan lacks a clear definition of the concept of nature-based solutions and often uses the phrase interchangeably with ecosystem-based adaptation. The planning documents frequently discuss trade-offs and challenges associated with different climate adaptation measures but rarely reach a conclusion. The discussion regarding adaptation strategies therefore follows the Swedish trend of the rise of "the sustainable city" but what that implies is uncertain.

Keywords: nature-based solutions, ecosystem-based adaptation, Kristianstad Municipality, planning process, Swedish urban planning

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# 1 Introduction

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as the transformation of the climate's mechanisms and the fluctuations of its characteristics that endures for a longer period of time. Both internal and external processes can cause this. The external processes include human impacts, which is the main trigger for climate change (Masson-Delmotte et al., 2018). The amount of carbon dioxide levels in the atmosphere has risen from 280 parts per million to 414 parts per million since the mid 18th century, when the industrial revolution started. Therefore, it can be concluded that consequences such as emissions of greenhouse gases in the form of carbon dioxide, methane and nitrous oxide from human activities have had an extensive effect on the rapid changes in climate during the last 50 years (Edenhofer et al., 2014). According to the Framework Convention on Climate Change (UNFCCC) climate change is *“a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”* (Masson-Delmotte et al., 2018, Glossary). The UNFCCC directly links anthropological activity since the industrial revolution with climate change (Masson-Delmotte et al., 2018). Emissions of greenhouse gases have led to increases in temperature, climate change, and consequently ice sheets and glaciers melting, which eventually result in significant sea level rise. Even with a decrease of emissions, sea levels would still be rising since the ocean reacts to a decline slower than the atmosphere. Anthropological activity can nevertheless affect the rate of sea level rise by reducing human use of fossil fuels and thus emissions (SMHI, 2020a).

Rising sea levels in Sweden vary drastically depending on geographical location. In parts of the country there is essentially a zero-sum game between post-glacial rebound and sea level rise, and in other areas, the isostatic rebound is even more substantial than sea level rise (ibid.). Scania however, is partly affected by subsidence, which is occurring south of Sweden. Furthermore, the loose sediments in the coastal area of Scania make the region further susceptible for sea erosion. In a worst-case scenario climate analysis, sea levels around Scania are estimated to rise more than 2,5 meters in 80 years since it is currently rising with 3,2 mm per year (SGU, 2020). Rising sea levels can lead to erosion and more frequent floods that can alter beach areas and nearby housing. Apart from this, sea level rise can negatively influence biodiversity and agriculture (SMHI, 2020a). Kristianstad is a city located in northeastern Scania with approximately 35 000 citizens. The city has an excessive risk of being affected by

global temperature increases and sea level rise because of the lowland and vicinity to the ocean. The lowest point in Sweden is furthermore located in Kristianstad at 2,41 meters below sea level. Thus far, Kristianstad Municipality has implemented seawalls to prevent disastrous consequences of sea level rise and is currently prevailing in the discussion of biological-based solutions to the matter (SMHI, 2014). The established seawalls in Kristianstad are a so-called hard climate adaptation infrastructure that Swedish municipalities have a history of implementing. The measures are widely criticized for multiple reasons. The main reasoning against hard climate adaptation infrastructures is that they generally depend on man-made constructions, and because sea level rise is mainly caused by anthropogenic activities, it is argued that adaptation strategies against it should therefore not be human-built infrastructure. Beyond this, hard climate adaptation is also criticized as it can be bothersome for neighboring communities, disrupt nearby ecosystems, be expensive, inflexible and lack resilience (Sovacool, 2011).

Nature-based solutions and ecosystem-based adaptation are two relatively new concepts in planning against sea level rise that are rapidly increasing as strategies. The discourse between the concepts and how they relate to each other is a controversial topic that is extensively discussed by scientists. There are some dissimilarities in the definitions of nature-based solutions but it can be argued as deriving from several other concepts, including, and particularly ecosystem-based adaptation (Potschin et al., 2016). Given the urgency of climate change and its consequences, studies on adaptation measures, especially nature- and ecosystem-based ones, their pros and cons are crucial. Moreover, studies on Sweden are limited, particularly given the novelty of the already implemented hard infrastructure. Thus, the relevance of my work is significant and will fill a much-needed knowledge gap.

## **1.1 Aim**

The aim of this thesis is to investigate and analyze how municipalities affected by sea level rise apply nature-based solutions in their planning process. The thesis explores particularly how nature-based solutions are included in the discussion, how they are presented in various planning documents in relation to how they are or will be implemented. As increasingly more municipalities, especially in Scania, focus on climate adaptation in the planning process this subject is to a greater extent relevant. Since the thesis has a relatively narrow time frame, it will be established by examining the case of Kristianstad Municipality. The thesis will analyze how the municipality includes nature-based solutions in their planning process by

reviewing the coastal and maritime spatial planning plan and the climate adaptation plan and furthermore conducting interviews with key informants. This will illuminate how the nature-based solutions are presented in contrast to how they are (or projected to be) implemented.

## **Research questions**

- Which nature-based solutions are included in Kristianstad Municipality's planning process?
- How does the municipality present the included measures in the planning documents for coastal and maritime spatial planning and climate adaptation?
- How are nature-based solutions implemented?

## **1.2 Limitations**

There are numerous ways to plan a community in a preventive manner towards rising sea levels. Since the thesis has a limited time frame, the research will only focus on nature-based solutions and ecosystem-based adaptation in the planning process. Furthermore, since it is a case study, the thesis is limited to Kristianstad. The municipality was chosen because of the city's geographical location, which means that rising sea levels considerably affect several aspects of the planning process. In a city like Kristianstad, where rising sea levels are a hazard socially, culturally and economically, climate adaptation measures are more urgent than ever.

## **1.3 Structure of the thesis**

The essay is structured in seven parts. The introduction presents the issue, provides a motivation of the subject's importance and makes a brief introduction to the case study and its relevance. The section continues with the aim, research questions and limitations. Section two introduces fundamental background information needed to understand the thesis regarding sea level rise, coastal erosion and climate adaptation with a Swedish context to the issues. The third section introduces the conceptual framework that the essay is based upon. Here both ecosystem-based adaptation and nature-based solutions are discussed and defined. Furthermore, a discussion regarding Swedish urban planning is provided. The fourth section establishes the research strategy; methods used and clarify the advantages and disadvantages of each method. The case of Kristianstad Municipality is also further discussed. Section five examines the results with a following analysis in section six that links back to the conceptual framework. Lastly, section seven concludes the thesis with answering the research questions, a short summary of the thesis and suggestions for further research of the topic.

## 2 Background

The aim of this section is to provide the reader with background information about sea level rise, coastal erosion and climate adaptation strategies with a Swedish context regarding the subjects. The background section will therefore start off with a wider scope concerning how climate change has affected sea levels and consequently coastal erosion. Thereafter, different climate adaptation will be discussed to additionally understand underlying assessments and understandings. Finally this section will narrow down into Swedish context of the issues and policies for rising sea levels. Nevertheless, these topics are global phenomena with countless research projects and reports but because of the thesis' narrow time frame, only a limited extension of background information and previous research are included.

### 2.1 Sea level rise

In *Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities* of IPCC's *Special Report on the Ocean and Cryosphere in a Changing Climate* concludes that the main contributor for global mean sea level rise is the melting of glaciers and ice sheets, where human-caused climate drivers are the predominant forces. Sea levels have increased from 1.4 mm/year, according to data from 1901-1990, to 3.6 mm/year (Oppenheimer et al., 2019). The assessment regarding global mean sea level rise is generally that sea levels will increase with less than 2 meters. Nevertheless, people that are currently living in areas projected to be below high tide lines by 2100 will increase from 110 million to 190 million. Furthermore, the number of people living on land projected to subsequently be affected by annual flood levels will increase from 250 million to 630 millions by the same year. It is therefore necessary for coastal areas' planning to include estimations of sea level rise to evaluate climate mitigation and worst-case scenarios, especially if precautions are not taken and adaptation measures are not implemented (Kulp & Strauss, 2019).

Furthermore, Oppenheimer et al. (2019) explores the changes in infrastructure, communities and habitability as a consequence of climate change, as hazards associated with sea level rise are predicted to surge in low-lying coasts if further adaptation measures are not implemented. The ramifications of not implementing climate adaptation include fewer occurrences of critical sediment and changes in the quality of freshwater at coastal deltas. Up until now, low-lying coastal areas are mainly the places that have implemented adaptation measures since the need for it has been more urgent. This means that the current effect of sea level rise is not as tangible in some low-lying areas. However, the previously implemented measures tend to be

short-term fixes and mainly focus on local or regional issues, neglecting future sea level rise impacts. There are also observed repercussions of sea level rise on coastal ecosystems, which is a result of anthropogenic causes such as expansion of the built environment and human-induced habitat degradation. The coastal ecosystems that in some cases operate as defensive barricades, slowly succumb to their purpose of acting as such because of climate-induced changes. Other risks with sea level rise include changes for nearby infrastructure and communities since there will be agricultural and livelihood changes (Oppenheimer et al., 2019).

### **2.1.1 Coastal erosion**

Coastal erosion is a phenomenon that has been occurring for several million years (SGU, 2020). The natural process has however intensified because of sea level rise and the occurrence of natural disasters, such as floods, during the last fifty years (Mentaschi et al., 2017; Rymdstyrelsen, n.d.). Erosion is the degradation of rocks and minerals where waves and streams transport the sediments. The erosion can fluctuate depending on the substance of sediments but is most commonly in occurrence with high tidal waves (SGU, 2020). The development of coastal morphology is in addition to sea level rise and natural disasters also affected by anthropogenic activities. During high tidal waves, parts of the nearby land are sporadically submerged, which leads to sediments eroding on the submerged coastal landscape. Consequences include land loss and gain in the geomorphological scenery, and in a global long-term observation of coastal erosion it was concluded that the amount of land that is eroded is twice the area of attained land. Transformations of coastal morphology as a result of these processes directly alter nearby communities, constructions and ecosystems. The aftermath of coastal erosion is therefore a decrease in livable land (Mentaschi et al., 2017) and undermining of infrastructure that can lead to landslides (SMHI, 2020a).

## **2.2 Climate change adaptation**

Planning against the threat of rising sea levels widely discussed and relevant at this time. Hard coastal protection strategies in regards to adaptation measures are extensively implemented internationally since they have largely been legitimized and deemed to be dependable and reliable (Oppenheimer et al., 2019). Ecosystem-based adaptation on the other hand, which correlates to the concept of nature-based solutions (Cohen-Shacham et al., 2016), is not as well established as hard coastal protection measures are. Although the attention regarding these measures is advancing, there is nevertheless some debate regarding its ramifications in

terms of economic burdens and long-term benefits (Oppenheimer et al., 2019). Hard adaptive measures are characterized as financially demanding, extensive, sophisticated and immobile structures whereas soft adaptive strategies would rather facilitate natural capital, retainment and local suitability (Sovacool, 2011).

The IPCC report additionally argues that there lies strength in materializing and combining several adaptation measures simultaneously. The different adaptation measures have specific advantages and disadvantages, which means that there lies synergy in combining them. Hard protections can have negative consequences in the form of increased exposure in the future but are nevertheless cost-effective similarly to flood proofing buildings and implementing early warning systems for extreme sea level events. Ecosystem-based adaptation is not as widely implemented so far, but can reduce coastal hazards and contribute with other advantages. Retreating from vulnerable areas can be productive but can at the same time be socially, culturally and politically demanding. However, the difficulties can be applied in regards to all adaptation measures. Sea level rise triggers discussions concerning social aspects about diminishing those most defenseless and raises the debate regarding capabilities. Something that always needs to be regarded when determining what adaptation strategy to enforce is the trade-off between the uncertain future, economic growth, safety and social aspects. Nevertheless, adjustments and agreements should be made in a foreseeable future to operate proactively (Oppenheimer et al, 2019).

### **2.3 Sea level rise, coastal erosion and adaptation in Sweden**

Different regions of Sweden are affected by sea level rise in various ways depending on the area's postglacial rebound. Northern Sweden is thus far not affected by sea level rise whereas the issue is already occurring in southern Sweden (SMHI, 2020a). Beaches that are mainly exposed to erosion are the low-lying and flat beaches located in Scania and Halland in southern Sweden. In these beaches, sand is transported by waves, currents and winds and alternates between erosion and accumulation of sediment. Sediment is therefore sporadically disappearing, which makes the beach narrower, and deposited, which makes the beach wider (SGU, 2020). As Mentaschi et al. (2017) argued, both land loss and land gain are consequences of coastal morphological changes but after observation, the conclusion is that land loss is the result of sea level rise and coastal erosion.



**Figure 2.1.** Map of areas in Scania below + 3 meters over sea level (SGU, 2014 in Kristianstads kommun, 2019)

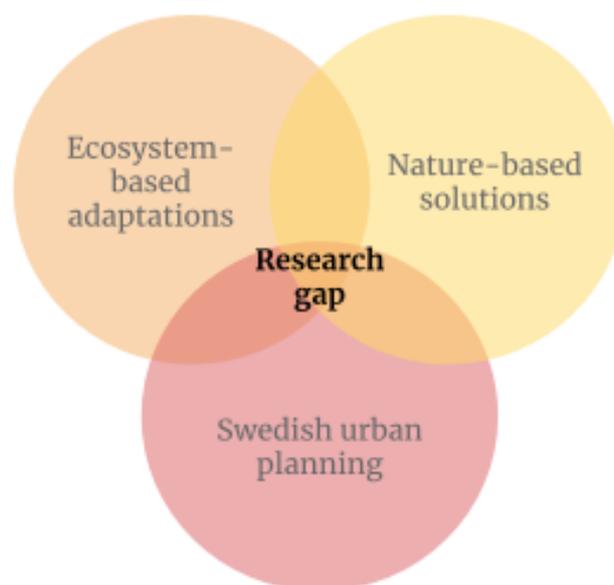
During 2018, the government proposed a national strategy for climate adaptation. The bill included two changes in the Swedish Planning and Building Act (Plan- och Bygglagen, PBL). The alterations of the law means a requirement on municipality's comprehensive plan to include a perspective on risks for the built environment as a consequence of climate-related floods, landslides and erosions, and a proposition of how this can be reduced or ceased. In addition, the bill proposes that in addition to municipalities' detailed development plans, a land permit for measures that may impair the permeability of the land can be required. The national strategy for climate adaptation was manufactured to sustain the work with climate adaptation and the national cooperation of the matter (Prop. 2017/18:163). Furthermore, the Swedish Environmental Protection Agency (Naturvårdsverket) released the first national guideline for nature-based solutions in climate adaptation (see 3.2) (Naturvårdsverket, 2021b).

Regional kustsamverkan (RKS) (The Regional Coastal Cooperation) has therefore been organized to coordinate coastal issues. RKS is a collaborative effort between the county administrative boards of Scania and Halland, Swedish Geotechnical Institute (SGI), Geological Survey of Sweden (SGU) and the coastal municipalities of Scania and Halland. Other involved parties include additional authorities, universities and concerned stakeholders. The aim of RKS is to produce and spread awareness regarding sustainable solutions to manage challenges related to sea level rise and coastal erosion for instance. RKS directs their

gathered information to policy makers to further illuminate the need to implement climate change adaptation measures at coastal areas. Currently, policies regarding intricate coastal issues are left to municipalities and individual property owners, which is argued as unwarranted. A more holistic perspective with coordinated efforts is therefore necessary with both regional and national support. Implementing appropriate measures require extensive coordination, cooperation and a clear division of responsibilities and financial resources, which is currently lacking in the process. RKS was therefore founded to fill in this gap (RKS, n.d.).

### 3 Conceptual framework

The conceptual framework for this thesis is first and foremost based on nature-based solutions and ecosystem-based adaptation in the planning against sea level rise. This is furthermore going to be analyzed through Swedish urban planning in regards to sustainable development. The theoretical framework will therefore firstly give an overview over definitions of ecosystem-based adaptation and nature-based solutions and a literature review of the subjects. It will thereafter continue with a Swedish perspective on urban planning through the aspect of sustainable planning and discuss some legislations and the national guideline for nature-based solutions. Nyström and Tonell (2012) discuss the emerging field of “the sustainable city” and how the role of comprehensive plans relates to climate change and its consequences. This has moreover shaped adjustments and alterations in legislations and regulations. How ecosystem-based adaptation and nature-based solutions are addressed and implemented will therefore be investigated through this frame.



**Figure 3.1.** Figure of subjects included in the conceptual framework and the addressed knowledge gap

In sum, the theoretical framework covers nature-based solutions and ecosystem-based adaptation through the perspective of Swedish urban planning.

#### 3.1 Ecosystem-based adaptation

Ecosystem-based adaptation is defined by the Convention on Biological Diversity (CBD) as “the use of biodiversity and ecosystem services to help people adapt to the adverse effects of

*climate change as part of an overall adaptation strategy*" (CBD, 2009:41). The definition was further clarified and included "*sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities*" (CBD, 2010:3). Per definition, ecosystem-based adaptation focuses on biological perspectives in combination with other essential aspects for affected communities. This is seen as one of the dominating strengths of the adaptation measure since ecosystems are closely linked to economic, social and cultural issues (Nalau et al., 2018). There are however some disparities in how organizations and stakeholders interpret the concept. In some cases, establishments conceptualize the approach as adaptation *of* ecosystems to plan against climate change instead of what it is supposed to signify, which is using ecosystems *for* human adaptation to climate change (Doswald et al., 2014). The field is steadily emerging as a strategy for climate adaptation, but still has some knowledge gaps (Nalau et al., 2018).

Globally, ecosystem-based adaptation has grown into a more favorable measure to implement in developing countries. This is paradoxical since the need for a profound understanding of the effect of climate change on ecosystems is needed during the implementation of ecosystem-based adaptation, something that is seldom attainable in countries that are currently associated with the measures. One of the conditions that restrict the use of ecosystem-based adaptation is the knowledge gap regarding the subject. The comprehension of the measure's capacity and efficiency is restrained since there is a lack of specific examples of executed ecosystem-based approaches (ibid.). According to Doswald et al. (2014), knowledge of the adaptation strategies has mainly come from smaller case studies led by local communities, which is deemed as unreliable. Therefore, a systemic foundation of the subject was established with various stakeholders to determine the data, documentation and proof for ecosystem-based adaptation's efficiency. Because of this, policy makers are cautious regarding the measures. Doswald et al. (2014) provided an evaluation of the then current evidence-base to widen the understanding of what factors were adequate and what aspects were scarcer. Since then, numerous research projects and case studies have been conducted regarding the subject. Asia and Oceania are places that heavily rely upon marine and coastal environments and have high biodiversity. These places are nonetheless highly affected by climate change and are thus often subject to research regarding the topic. The results of an analysis of ecosystem-based approaches was mainly that the measures were implemented on a local or regional scale, presented administration over adaptiveness and

consisted of either governance by local communities or shared control (Giffin et al., 2020). The Destination Ecosystem-based Adaptation Framework has been applied to a case study in Tanna island in Vanuatu, a Pacific island, which concluded that the measures can be presented as a means for the tourism and travel industry to forge comprehensive advantages (Loehr et al., 2020). The case study of the Caribbean Small Island Development States (SIDS) in relation to ecosystem-based adaptation also had similar outcomes and results. In the Caribbean SIDS, implementation of these strategies heavily depended on local knowledge, which resulted in discoveries of substantial synergies between combining this with external competences (Mercer et al., 2012).

Furthermore, there are economic, social and tangible constraints in terms of budgets, cultural issues and biological boundaries. Because of this, expanding, implementing, auditing and assessing suggested ecosystem-based adaptation are complicated and need further research. Nevertheless, the measures are considered to be economically worthwhile and sustainable alternatives since there are benefits in synergies when complemented with other measures. When implementing ecosystem-based approaches, the issue of climate change is prevented while it at the same time is favorable for biodiversity, which leads to positive consequences for local communities. The scope of the strategy is therefore commonly on a local scale. As ecosystem-based adaptation is especially effective when implementing place-based measures, close cooperation with communities are often enforced to utilize local knowledge of places. The strategy is, as a result, generally linked to community-based adaptation, which is a measure that beyond focusing on a local scale, also assures that the implemented efforts are in line with the community's development goals, health and resilience (Nalau et al., 2018).

### **3.1.1 Nature-based solutions**

Cohen-Shacham et al. (2016:xii) and the IUCN define nature-based solutions as “(...) *actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits*”. Nature-based solutions are arguably derived from ecosystem-based adaptation (Potschin et al., 2016) and both concepts are relatively new and still need to be defined and clarified for a more universal understanding. The IUCN suggests some key principles for nature-based solutions. Primarily, the strategies should take nature conservation norms and principles into account and be able to be applied by themselves or in combination with other

adaptation measures. Furthermore, they should be determined depending on the specific location in regards to local and traditional expertise; they should also generate impartial societal advantages, and preserve biological and cultural diversity and its future development. Lastly, the measures should be implemented at an existing landscape and acknowledge the controversy and trade-offs between its advantages and other aspects and therefore be a fundamental part of policies. In addition, it is stated that a precision in practicality is needed for nature-based solutions to be valid and more widely satisfactory. The IUCN has clarified their main goal, definition and principles of nature-based solutions and are currently developing the operational parameters for the measures. Furthermore, natural capital is discussed, and the fact that there are limitations to the amount of it. Natural capital is the paramount for other capital such as manufactured, financial, human and social which is why Natural Capital Approaches' (NCAP) goal is to illuminate the value of it more. When natural capital is being valued higher it results in positive effects for biodiversity and ecosystems (Cohen-Shacham et al., 2016).

Nature-based solutions are gaining more and more awareness and recognition but have not fully been adapted into comprehensible practice. There are still concerns about nature-based solutions in regards to the cost-effectiveness of the measurements and the long-term outcomes. Since they are relatively new strategies, policies are not shaped for them yet and can therefore, at times, interfere with the implementation process. First and foremost, nature-based solutions need to be legitimized and proven to be beneficial for governments. Previous research that validates the measures in regards to coastal management includes IUCN's report *Nature-based Solutions to address global societal challenges* and several research articles. The IUCN report includes a UK-based case study concerning an approach to manage realignment of coastal defenses that was overall successful (Cohen-Shacham et al., 2016). Nature-based solutions have arisen as a productive response to hydro-meteorological and other natural hazards as well as global challenges such as climate change. Almost all research is coherent in the fact that nature-based solutions are proven to have positive impacts and have promising growth potential but need more research before full implementation. Conclusions drawn from investigating and mapping out nature-based solutions and its consequences include determining insufficient elements and identifying areas for further research. The nature-based solutions that have been explored thus far have been established as economically beneficial, sustainable and synergistic (Chausson et al., 2020; Ruangpan et al., 2020). Furthermore, it has been concluded that the preferred measure should be dependent on

the location to optimize the outcomes (Debele et al., 2019). Negative effects that can come from nature-based solutions include trade-offs in policies, leading to maladaptation. Governments and regulations can in some cases prevent and obstruct when applying the strategies. Cooperation between scientists and policy makers are therefore encouraged in order to develop procedures and facilitate nature-based solutions (Seddon, 2020).

### **3.2 Swedish urban planning**

According to Nyström and Tonell (2012), environmental issues are one of three aspects that are getting increased significance in urban planning the most. The focus on “the sustainable society” (my translation of “det hållbara samhället”) has become more important for policy makers and municipalities. Since the needs and interests are dynamic and constantly changing, legislation, policies and guidelines are obliged to alter with them. PBL was for instance revised and came into force in 2011, where the importance of a sustainable society was strongly emphasized and furthermore accentuated the need for climate change to be taken into account in all aspects of urban planning (Nyström & Tonell, 2012:311-312). PBL is furthermore the basis of comprehensive plans and regulates them as the legislation states that the primary aim for comprehensive plans is to be indicative for strategic planning in premises of physical environment in a long-term perspective (SFS 2010:900). Therefore, a comprehensive plan generally includes strategic guidelines for the development of several areas such as services, housing and public transport. The comprehensive plan’s role is to compile and describe how the municipality views their current situation and suggest plans for further development (Nyström & Tonell, 2012:163-166). Moreover, environmental aspects should be accounted for in a comprehensive plan in the form of a hazard analysis and vulnerability assessment, which should include climate change and its consequences. With the surge of planning for “the sustainable society”, climate related issues have also been more highlighted in planning processes. Nyström and Tonell (2012:311-314) furthermore state that a more overarching perspective with sustainability and climate adaptation incorporated to a greater extent in more aspects is prevailing. In addition, it is the municipality’s responsibility to include an assessment regarding damages that are possible as a consequence of climate change, such as erosion and floods. This assessment should also encompass future prospects for the possible consequences in terms of an evaluation concerning whether the risks are inclined to increase or decrease. Subsequently, some municipalities, such as Kristianstad, also have a climate adaptation plan that aims to specifically address these matters (SMHI, 2020b).

The national strategy for climate adaptation that was proposed by the government is therefore a further manifestation of the advancement of the significance of climate adaptation in state legislation (Prop. 2017/18:163). Another argument that confirms the importance of the subject is the government assigned task of coordinating national climate adaptation measures in urban areas which the National Board of Housing, Building and Planning also works with (Boverket, 2021). The work regarding climate adaptation is nevertheless paradoxical since considerable resources in several fields are directed to research aimed at sustainable development (Nyström & Tonell, 2012:311) and several organizations, such as RKS, have been assembled to specifically address these subjects (RKS, n.d.). On the other hand, the budget for The Swedish Civil Contingencies Agency (MSB) grants regarding nature conservations, which can be applied for by municipalities, has been lowered from 75 million SEK in 2020 (Rosholm, 2020) to 25 million SEK in 2021 (MSB, 2021).

As aforementioned, the Swedish Environmental Protection Agency recently released the first national guideline for nature-based solutions in climate adaptation. The report is focused on the fundamentals and effects of nature-based solutions and can therefore be used by everyone working with climate adaptation issues ranging from politicians and officials in municipalities and county administrative boards, to landowners or developers. The guideline is outlined in six parts - identifying risks in relation to climate, mapping of the socioecological context, potential solutions, choice of solution, implementation and lastly evaluation. Nature-based solutions are described as cost-effective and multifunctional in the report. Their advantages include protecting, developing and creating ecosystems whilst also improving biodiversity and human well-being. One of the strengths with this type of measure is the ability to manage intertwining aspects such as climate, biology, ecosystems and social sustainability. The measures can therefore be used in planning against climate change since studies have shown that nature-based solutions have the potential to reduce 30 % of emissions that are needed to reach the two-degree target by 2030 (Naturvårdsverket 2021a; Naturvårdsverket 2021b).

Nevertheless, the dominating model in urban planning in Swedish cities is attractiveness and density of urban areas. The main subject that is focused on for a sustainable city is a holistic approach to sustainable development with a person-centered focus. This also includes a focus on place-based adaptations, diverse functions, green spaces, resource efficiency and sustainable transportation. Anthropogenic activities affect different natural cycles (Nyström & Tonell, 2012:313-315), and the human impact of sea level rise and coastal erosion are already established. The assessment of how to confront these issues is however still a complex matter

that is largely under debate (see e.g. Mentaschi et al., 2017; Oppenheimer et al., 2019; SGU, 2020). Nyström and Tonell (2012:316-317) moreover discuss the interdisciplinary approaches that lie within a successful planning process. When several departments cooperate, conflicts can naturally occur because of different issues, knowledge and views on the matter. Officials involved in the planning process need to both collaborate with other municipality-employees, but also with politicians, which, in some cases, can halt and complicate the implementation of different solutions. Nonetheless, the value lies in the synergy between combining competences and expertise among municipality officials and also between municipality workers and citizens.

## 4 Methodology

This section aims to explain the research strategy and methods for the thesis. The research strategy is based on the case of Kristianstad Municipality and to answer the overarching research question of ‘*Which nature-based solutions are included in Kristianstad Municipality’s planning process?*’ a combination of analyzing secondary data in the form of documents and semi-structured interviews were conducted. The advantages and disadvantages to each method are analyzed in order to make the reader understand the consideration behind the chosen methods. The section therefore starts off with an explanation and discussion concerning the research design and choice of case study. An introduction to Kristianstad Municipality with in-depth information concerning the city is also presented. This will include information regarding the city’s preconditions, previous climate change adaptation measures and different planning documents. The section will continue with a discussion regarding the choice of methods and specifically argue as to why secondary data and semi-structured interviews were chosen. The mixed-methods approach is used in order to fill out possible potential gaps if only one method were to be chosen, and since each method is beneficial to investigate the research questions. Lastly the section concludes with a discussion concerning data analysis with an explanation concerning the development of the codebooks and the choice of qualitative data.

### 4.1 Case study

When determining the research strategy, suitability, feasibility and ethical aspects were considered. Considering the thesis’ limited timeframe, a case study was chosen to investigate nature-based solutions as a climate change adaptation strategy. The nature of researching a specific circumstance is what classifies the project, as a case study. The analyzed specific circumstance is in this case nature-based solution in planning processes, in particularly Kristianstad as the geographical area. This gives comprehensive expertise and understanding regarding the case that would be lost with more general research strategies, such as surveys (Denscombe, 2010:52-53). A case study is defined as the study of “*a phenomenon (the “case”) in its real-world context*” according to Robert K. Yin (2010:17). The choice of Kristianstad was furthermore beneficial to me as an author since I have done an internship where I extensively worked with LIFE Coast Adapt and specifically Kristianstad’s role in the project. This has given me privileged knowledge and practical assets to data sources such as contact with interviewees (Denscombe, 2010:3-8).

Although the case of Kristianstad Municipality is in many aspects one of a kind, it can be generalized by perceiving it as an example of how coastal municipalities apply nature-based solutions. The scope of generalization is, however, determined by the similarity to other cases in regards to for instance different circumstances or planning processes. Even though the case examines nature-based solutions as a climate change adaptation strategy in a broad sense, it cannot be compared to every city or municipality. It can, nonetheless, to some degree be related to other coastal areas, especially in southern Sweden, and therefore some conclusions can be drawn. This is known as transferability which means that the responsibility concerning generalization is at the hands of the reader. The generalization of the case therefore lies in whether the data can be transferred to another case and setting, which the reader must assess. It is however necessary for the researcher provide sufficient data for the potential user of the findings to be able to make an informed assessment (Maxwell & Chmiel, 2014). With the background data, results and conclusions presented in the thesis, the reader should evaluate how applicable their point or case is in contrast to Kristianstad. Since municipalities in Sweden have monopoly on the control of land use, the generalization of the case of Kristianstad is primarily limited to a Swedish context. When comparing this case, different aspects should also be considered such as Kristianstad's geographical context, low-lying land and political governance. Case studies can furthermore be justified by the possibility of the case acting as a knowledge base for other instances with similar precedence (Yin, 2010:18).

In this sense, a case study was preferred since an in-depth analysis of Kristianstad Municipality was needed. To be able to answer the research questions of the thesis, qualitative data is mainly required, which means that a case study was suitable. This research strategy does not restrict the research design by establishing any rules for a particular method but is further improved by combining several methods. Nevertheless, the case of Kristianstad was consciously chosen for several reasons. Partly because of the prior knowledge I had obtained about the municipality's implementation measures through my internship, but also because of the urgency for climate adaptation strategies in Kristianstad because of the city's preconditions. In addition, there is limited research regarding nature-based solutions as an adaptation strategy and few municipalities have worked with the measure to the extent that Kristianstad has. The case was therefore chosen for its relevance (Denscombe, 2010:55-59).

The disadvantages of case studies nonetheless include difficulties in generalizing but also setting limits to the case. The research needed is specific, but can at the same time also

include a lot of details. Furthermore, when in contact with key figures, the observer effect can be a disadvantage. The object of study is aware that they are being observed which can lead to somewhat skewed data. Lastly, others can denounce the results since it heavily relies on qualitative data. Nevertheless, the advantages of a case study outweigh the disadvantages. As aforementioned, by studying Kristianstad Municipality, a holistic perspective of the case can be obtained by examining a phenomenon - nature-based solutions as a climate change adaptation strategy. Since case studies also encourage a mixture of several research methods, this validates the results through triangulation whilst capturing the complexity of the case (Denscombe, 2010:62-63). According to Denscombe (2010:53) “*The aim is to illuminate the general by looking at the particular*” which can be done by examining Kristianstad.

### **Kristianstad Municipality**

Kristianstad is a city located in northeastern Scania with approximately 35 000 citizens (SMHI, 2014). A coastline of about 42 km<sup>2</sup> surrounds the city, which is one of the most important aspects for the municipality in terms of nature, recreation and tourism (Kristianstads kommun, 2019:7). In order to prevent further problems generated by sea level rise, this must be taken into account in the planning process (Kristianstads kommun, 2018:4). The lowest point in Sweden is located in Kristianstad at 2,41 meters below sea level, which means that the city has an excessive risk of being affected by global temperature increases and sea level rise (SMHI, 2014). This is especially a pressing matter along the shore of Åhus and south of this area where the sediment is sandy, and in the area of the river Helge å because of the flows. Sea level rise will therefore cause disturbances with erosion, flood risks and difficulties with groundwater. A consequence of global mean sea level rise is the decreased capacity of disposal of stormwater. Infrastructures in the vicinity of the coast are therefore at risk, especially during winter. The county administrative board recommends that municipalities calculate the worst-case scenario when discussing climate adaptation strategies and currently, the minimum height of new constructions in Kristianstad is 3,3 meters (Kristianstads kommun, 2019:7 & 16-17). The municipality works strategically to adapt itself to a changing climate and its consequences and was appointed Sweden’s best municipality in regards to climate adaptation. Nevertheless, there is still room for improvement for Kristianstad such as coordinating the work on a more overarching level in order to clarify what responsibilities lie with which organization (Kristianstads kommun 2018:4-5).

Historically, Kristianstad Municipality has implemented seawalls as a protection measure against floods (SMHI, 2014). This strategy was initiated several years ago and is still under development for improvement. A combination of seawalls, pumping stations and stormwater ditches is what currently shelters the city, and Kristianstad can therefore be perceived as an embankment dam since the seawalls are required to ensure that no water seeps through. Even though the walls are hugely significant to the city and have thus far been favorable, they need to be further developed and extended. This can however come with negative impacts since it would mean more land-use and that the municipality is the sole responsible party since Swedish regulations state that the municipality themselves are liable for damages that may arise, regardless of the source of the problem. Furthermore, in 2002, Kristianstad was exposed to a flood, which led to the development of the embankments in Hammarlund. As additional measures and in case of emergency, Kristianstad is on standby mode with further implementation measures such as expanding the seawalls as well as other mobile reinforcements, for example pumps. Moreover, the municipality monitors water flows closely through a system they call Flood Watch that can anticipate water flows ten days in advance (Kristianstads kommun, 2021).

In November 2019, the Municipal Council adopted Kristianstad's first coastal and maritime spatial planning plan. The plan is an amendment to the comprehensive plan and aims to advance sustainable development by establishing future strategies and is a step in the right direction for the national environmental goals. Furthermore, the purpose of the plan is to examine trade-offs between interests and stakeholders. As the Swedish Agency for Marine and Water Management was working with the first national coastal and maritime spatial planning plan, Kristianstad developed an equivalent plan on municipality level (Kristianstads kommun, 2019:3). In addition to the coastal and maritime spatial planning plan, the municipality also has a climate adaptation plan. The Municipal Council adopted the climate adaptation plan in January 2018. The plan identifies key challenges for the municipality's coastal development and proposes areas for further development. Moreover, there is an attached appendix that discusses previously implemented measures and suggestions for additional measures (Kristianstads kommun, 2018). Because of the low-lying land and the fact that Kristianstad is a coastal city, climate change adaptation strategies are urgent matters (Kristianstads kommun, 2019:16-17).

According to MSB, Kristianstad is classified as an area with significant flood risk, which can potentially damage infrastructure (Kristianstads kommun, 2021). In Kristianstad's work with

climate change adaptation strategies there are currently two nature-based solutions projects that are significant - LIFE Coast Adapt and a project dubbed as Drömprojektet. LIFE Coast Adapt is a EU-funded project where the main purpose is to test different nature-based approaches around Scania's coast to prevent the negative consequences of coastal erosion. Two measures were tested at Kristianstad - planting and amplification of eelgrass meadows and establishment of a natural reef. Both measures were tested at Tället, a recreational beach. Stage one of both measures was initiated during 2019 and has since been closely monitored and controlled (Kristianstads kommun, 2020). The World Wide Fund for Nature Sweden (WWF), on the other hand, funds Drömprojektet together with Kristianstad Municipality's Vattenriket. The main objective of the project is to do a large-scale plantation of eelgrass to restore their biodynamic functions. The project is led by WWF Sweden and aims to recreate the viability of the Baltic Sea. Kristianstad has therefore been chosen as one of three locations to implement measures at (Pearce, 2020).

## 4.2 Methods

When choosing methods, it is important to evaluate the advantages and disadvantages to each. All methods are flawed in some aspect, but if used correctly can be an asset depending on what the researcher is aiming to accomplish. When choosing methods for this thesis, the usefulness of them was considered. Gathering secondary data in the form of municipality documents to analyze for instance is useful to understand the discourse and underlying plans for nature-based solutions. This however, needs to be complemented with semi-structured interviews with key informants to understand how the measures are aimed to be implemented. The choice of a mixed-method approach is also beneficial in the sense that they can compensate for one another in their strengths and weaknesses. Furthermore, when using more than one method, triangulation is possible to enhance the credibility of the results (Denscombe, 2010:153-154).

### 4.2.1 Secondary data

To specifically answer the research question '*How does the municipality present the included measures in the planning documents for coastal and maritime spatial planning and climate adaptation?*' secondary data was gathered to research Kristianstad's official documents. A critical examination of the municipality's publications was conducted to make an assessment of how the municipality presents and discusses the measures in the documents. The secondary data was in addition gathered to understand how Kristianstad Municipality comprehends the

concepts of ecosystem-based adaptations and nature-based solutions, but also to investigate how concrete implementation proposals are discussed in the municipality's plans.

The two publications that were investigated were the coastal and maritime spatial planning plan and climate adaptation plan that were both coded (see 4.3). As aforementioned, the former is an amendment to the comprehensive plan whilst the latter specifically examines issues related to climate change and adaptation management. Moreover, the thesis only analyzes two planning documents from Kristianstad, which was purposefully chosen considering the time limitation and since these documents are the most relevant ones in regards to the aim of the thesis. Nonetheless, the plans provide opportunities for further investigation of implementation strategies in the planning process against the threat of rising sea levels. When using official government documents, the validity nevertheless needs to be considered. Government publications are fairly considered as legitimate as they are seen as authoritative, impartial and accurate. The fact that Kristianstad themselves composes the plans *about* the city still needs to be taken into account. This means that the documents can be somewhat skewed in favor of Kristianstad and there is some bias in them. Researchers using the documents as data therefore need to critically evaluate the credibility of the composed texts (Denscombe, 2010:217).

Kristianstad's planning documents were furthermore relatively accessible. Since Swedish municipalities generally publish their reports online, analyzing documents and gathering secondary data is easily attainable. Both the coastal and maritime plan and the climate adaptation plan were retrieved from the official municipality website which was convenient in terms of time and cost-effectiveness. Nonetheless, there are also disadvantages to utilizing secondary data including credibility and the source and aim of the data. In this thesis, only municipality publications are used, which are generally recognized as valid. However, Kristianstad, as the creator of the documents, have had a specific purpose when producing them, which should also be considered (Denscombe, 2010:220-221 & 233). Regardless, documentary analysis was a preferred method for this thesis, especially in combination with semi-structured interviews (see 4.2.2). Lastly, the documents were coded in a qualitative manner (see 4.3).

#### **4.2.2 Semi-structured interviews**

To understand and answer research questions, "*Which nature-based solutions are included in Kristianstad Municipality's planning process?*" and "*How are nature-based solutions*

*implemented?*” two semi-structured interviews were conducted with key figures that directly work with LIFE Coast Adapt and Drömprojektet. Both interviews were performed through Zoom since the respondents are working remotely because of the pandemic. Quartiroli et al. (2017) has documented the convenience and advantages of Skype for data collection. The study discusses benefits with Skype such as adaptability and cost-effectiveness. In this thesis Zoom was used, which was arguably used the same way as Quartiroli et al. (2017) used Skype. Since I am not located in the vicinity of the respondents, using telecommunications applications also opened up opportunities to interview key figures that are not geographically at the same location as myself, which paved the way for relevant aspects in the thesis. Moreover, at the beginning of each interview, oral consent was given regarding recording, documentation and data management of the interviews. This is an important part since it is what separates interviews from casual everyday conversations. Furthermore, interviews were conducted to collect in-depth information regarding the complex matter of inclusion and implementation of nature-based solutions in the planning process that could not be obtained through examining documents. The respondents are key figures in different projects that use nature-based solutions which gives them information, insights and experiences that need to be explored in order to answer the research questions (Denscombe, 2010:172-174). Both interviewees were initially contacted via email to set a date.

The first interview was conducted with a Kristianstad municipality employee on April 9, 2021 with a total recorded time of approximately 45 minutes, which included small talk, formal discussions regarding consent, and was concluded with further pleasantries. The second interview was conducted with an employee at Skånes Kommuner (eng: Municipalities of Scania), which is an employer’s organization that represents and advocates for municipalities in Scania. This respondent was interviewed because of their role in Action C6 in LIFE Coast Adapt that is of significance. The interview was performed on April 19, 2021. It is important to note that somewhat of a relationship between the interviewees and myself were already established beforehand. Both interviewees were people I had encountered during a previous internship. The municipality employee was someone I had come across a handful of times during meetings but had no further communication with. The other interviewee was my supervisor at the internship, which meant that we had established a fairly comfortable relationship since before. The prior relationship could give both myself and the interviewee some biases but since the respondent is such a key figure in LIFE Coast Adapt this was

prioritized. Thereafter, both interviews were transcribed and coded according to a developed codebook (see 4.3).

The choice of semi-structured interviews gave further insights and perspectives to understand how Kristianstad Municipality applies nature-based solutions since the method required fundamental knowledge but was still adaptable in order for the respondents to further discuss their own expertise. The aim of conducting a semi-structured interview is for the respondent to illustrate and explain their perception of a certain occurrence whilst having an agenda of themes to discuss. Since a list of questions to be answered was composed in advance, research had to be conducted to be able to ask significant questions (see Appendix A & B). This also gave a better understanding of the respondents' replies and made the supplementary questions more engaging. Using semi-structured interviews means that the respondent can expand on their points of expertise, which results in more reliable answers. To conduct a semi-structured interview means that the interviewer needs proper knowledge regarding the respondent and the work in order to ask relevant questions to optimize the interview, as well as being flexible and potentially asking supplementary questions. The advantages with conducting an interview is therefore that personal opinions are lifted as well as additional understandings for complex questions and processes are gathered through the answered questions (Kvale, 2007:52-53).

When using semi-structured interviews as a method, it is important to also take disadvantages into account. Since the respondents are acting as officials representing Kristianstad Municipality and Skånes Kommuner, this can result in restrictions in the way they express themselves. In addition, factors such as age, gender and ethnicity of the interviewer can affect the perception of an individual and influence the way the interviewee chooses to answer. Since both respondents had a previous relationship with me, this was presumably not an issue. The results of the interview can however also vary depending on the interviewer's ability to observe, lead the conversation and form a bond or trust with the respondent. Lastly, interviews are time-consuming; both in terms of preparation work but also in the aftermath with transcribing and coding (Denscombe, 2010:178-180, 182-184, 193-194). In conclusion, there are both advantages and disadvantages to using semi-structured interviews as a method. The results are dependent on the interviewee's background and expertise as well as the interviewer's ability. In this case, both respondents are key figures concerning nature-based solutions in Kristianstad Municipality and are therefore assessed to give valid and reliable answers.

### 4.3 Data analysis

Since the thesis uses a mixed-methods approach with researching secondary data and conducting semi-structured interviews, the data collected from each method can be triangulated for advantages. A combination of the methods also meant that they could complement each other and widen the understanding of how nature-based solutions are implemented in Kristianstad Municipality. Qualitative data is used since the aim of the essay is to examine the holistic aspect of nature-based solutions in planning processes, which makes qualitative measures preferable. This is also beneficial since the thesis is a relatively small-scale project that focuses on in-depth analysis that should be described in words instead of numbers (Denscombe, 2010:237-238). The documents were indexed in order to be able to find the relevant material afterwards and audio recordings from the interviews were transcribed. Both the documents and the transcripts were furthermore coded in a qualitative manner. The material was coded in a first and second cycle with a final coding, which consisted of compiling relevant coded data from both cycles. This helped process the material considering that coding is an essential component between gathering the data and analyzing it. When the coding initially started, both codebooks were already developed, however, both of them were quickly altered after a pilot test. The different data sources were coded with particular coding methods to best fit the information (Saldaña, 2009:3, 62-63 & 65).

The two municipality publications were initially coded with a holistic coding method. Reading through the documents to get a basic understanding of the general themes was therefore the first step. Holistic coding is convenient for almost all types of data to gain an initial comprehension of the overarching theme of the data source and therefore the coded data. The gathered results of the holistic coding were thereafter managed to be able to be further coded in the second cycle with pattern coding. Transitioning the material from the first cycle to second cycle was nonetheless not done with either of Saldaña's (2009) methods code mapping or code landscaping. The material was rather compiled and organized to carry on with the second cycle coding. The pre-developed codebook was at this stage altered to fit the results with the aim of the thesis in mind as well, since the purpose of second cycle coding is to establish and reorganize the data in appropriate categories. This was accomplished with a pattern coding to find the most prominent and recurring themes that related to this thesis' research questions (Saldaña, 2009:165, 217, 230 & 233). Lastly, a content analysis was also conducted in order to quantify the qualitative data obtained from examining the documents. The data was furthermore analyzed by calculating the amount of times the category was

mentioned and in what context (Denscombe, 2010:281-283). Scholarly purists can criticize quantifying qualitative data but in this case it was deemed as fitting in order to understand how often Kristianstad talked about a certain topic in comparison to another subject. Obtaining this type of data can lead to relevant results when analyzing it (Saldaña, 2009:62-63).

According to Denscombe (2010:220) researching secondary data by analyzing documents is therefore suitable since the data is often convenient, does not require excessive preparations and avoids ethical difficulties. Furthermore, since one of the research questions is ‘*How does the municipality present the included measures in the planning documents for coastal and maritime spatial planning and climate adaptation?*’ the choice of analyzing documents, as a research method, was fairly inclined. Closely examining and critically reviewing the documents can lead to conclusions to the thesis. The finalized codebook is categorized in different general themes that were discovered in Kristianstad’s planning documents. The themes are furthermore classified with the research questions that they relate to. Finally, other themes of interests are also included in the codebook since relevant data was identified which did not wholeheartedly fit into any other category.

**Table 4.1.** Finalized codebook for Kristianstad’s planning documents

RQ	Theme	Definition
<i>How are the included measures presented in the planning documents?</i>	Nature-based solutions/ecosystem-based adaptation	Measures based on biological strategies such as planting of eelgrass, building of natural reefs and so on.
	Discourse of concepts	How the discourse of above concepts are treated.
<i>How are nature-based solutions implemented?</i>	Trade-off	Discussion regarding trade-offs between different climate adaptation strategies or trade-offs associated with implementing said measures.
	Implementation	Specification of how climate adaptation measures are supposed to or have been implemented. Include requirements for implementation and approaches to planning.
	Challenges	Existing challenges or ones that may arise concerning climate adaptation strategies.
<i>Other themes of interest</i>	Previous climate adaptation measures	What the municipality historically has implemented
	Other climate adaptation measures	Non-specified measures such as retreat or a combination of several strategies.

In order to analyze the data obtained from the semi-structured interviews, the audio recordings first needed to be transcribed. Even though transcription is a much-needed and admitted subsequent work after a conducted interview, it also has some disadvantages. When transcribing, oral information is being adapted into written data, which can strip the material from emotions and therefore alter the results. Nevertheless, it is an established part of interviews and is an essential step in order to code the data (Kvale, 2007:93-94). After the interviews were transcribed, the transcripts were coded with initial coding in the first cycle. Since the handled data is spoken words by key figures, the conversation did not always follow the pre-developed codebook and were often open-ended. In order to be susceptible to all angles that the interviews led to, initial coding was chosen as a method. This method is beneficial when exploring the gathered data to examine what course the results might follow. In the second cycle, focused coding was conducted to categorize the information. This method helped to discover the major themes that were discussed during the interviews. Furthermore, the most important and significant categories were established which led to a relevant final codebook that was applied to the research questions of the thesis (Saldaña, 2009: 100-101 & 236).

**Table 4.2.** Finalized codebook for semi-structured interviews

RQ	Theme	Definition
<i>How are the included measures presented in the planning documents?</i>	Nature-based solutions/ecosystem-based adaptation	Measures based on biological strategies such as planting of eelgrass, building of natural reefs and so on.
	Discourse of concepts	How the discourse of above concepts are treated.
<i>How are nature-based solutions implemented?</i>	Strategies	Overarching strategies for climate adaptation or strategic areas included in specific projects.
	Trade-off	Discussion regarding trade-offs between different climate adaptation strategies or trade-offs associated with implementing said measures.
	Implementation	Specification of how climate adaptation measures are supposed to or have been implemented. Include requirements for implementation and approaches to planning.
	Challenges	Existing challenges or ones that may arise concerning climate adaptation strategies.
<i>Other themes of interest</i>	Previous climate adaptation measures	What the municipality historically has implemented
	Other climate adaptation measures	Non-specified measures such as retreat or a combination of several strategies.

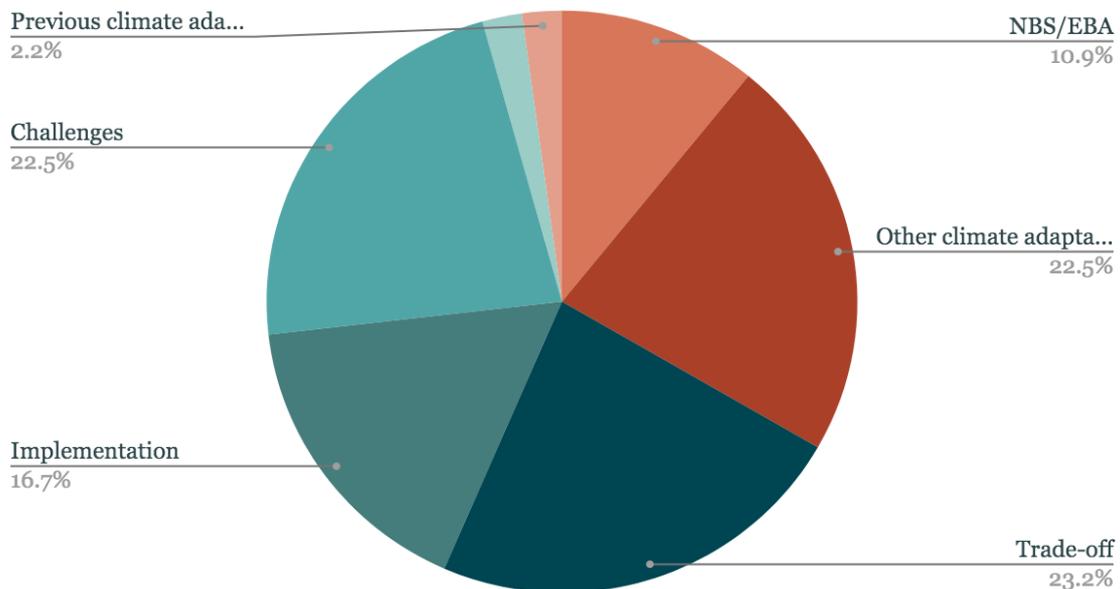
The data from the semi-structured interviews was therefore almost analyzed the same way as the secondary data but with less focus on the quantifying part. After coding the data, it was analyzed in terms of the content to assess the meaning of it with focused coding. This highlighted the main themes that were recurring in the interviews in relation to the aim of the thesis. Coding can also be described as ‘searching for patterns’, however, the patterns can be embodied in several ways. By both using initial and focused coding, major themes were discovered and further examined in order to fully comprehend the data (Denscombe, 2010:281-283; Kvale, 2007:205; Saldaña, 2009:5-7 & 236).

Only using qualitative data in the thesis however has some limitations such as being too atypical and not generalizable. Furthermore, the data can be analyzed disconnected from its context when transcribing or even coding, which can lead to misinterpretations. In the coding process, the documents can also be oversimplified in order for it to fit a certain box and be able to be coded, which can also lead to misleading results. These disadvantages can broadly be attached to the fact that the analyzing part is largely associated with the researcher. There is therefore always some subjectivity in qualitative data. Nonetheless, there are also advantages to qualitative data such as the in-depth level of information that is obtained, the understanding of the complexity of certain aspects and the openness to the possibility of other interpretations (Denscombe, 2010:304-306).

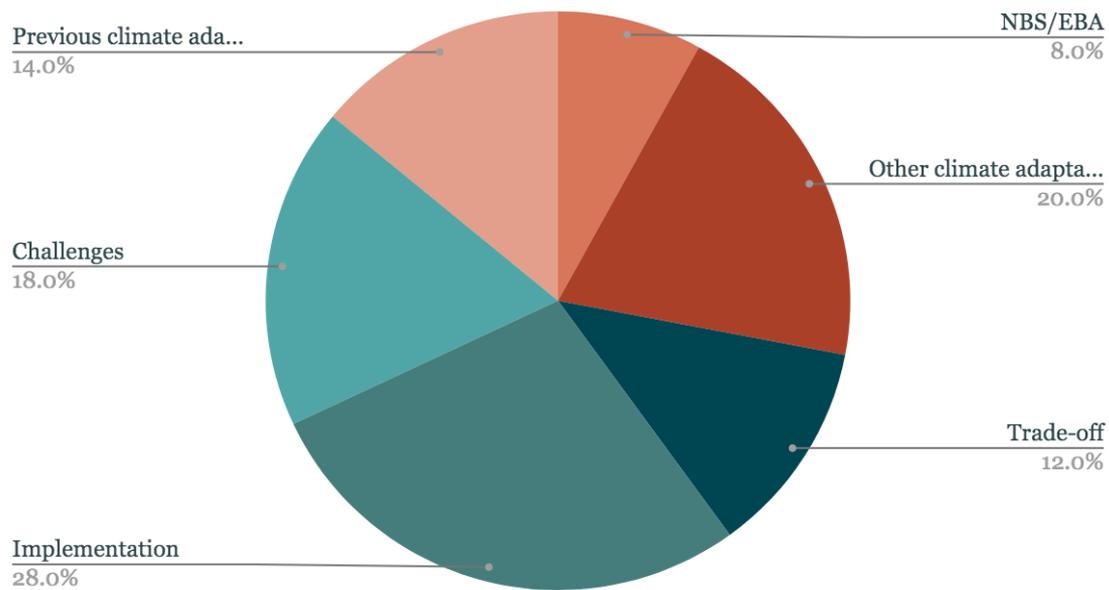
## 5 Results

This section presents the results from examining secondary data and transcripts from the semi-structured interviews. The results of the coded data are presented in text, figures and quotes. Furthermore, the results were initially gathered in Swedish since the secondary data is written in Swedish and the interviews were also held in Swedish considering both respondents are native Swedish speakers. Because of this, some perspectives and insights might be lost in translation but since the purpose of the obtained results is to find the overarching themes from the data and not specific elements, this is not considered an issue.

From now on the municipality employee will be referred to as Respondent A and the key informant regarding LIFE Coast Adapt will be referred to as Respondent B. In addition, worth noting when observing the results from the secondary data are the number of pages of each plan, the former has 108 pages whilst the latter has 43 pages. To make a more accurate portrayal of the results, pie charts of the percentage of each coded theme in relation to the total amount of coded items were produced.



**Figure 5.1.** Coastal and maritime spatial planning plan: Percentage of each coded theme in relation to total amount of coded items



**Figure 5.2.** Climate adaptation plan: Percentage of each coded theme in relation to total amount of coded items

## 5.1 Including adaptation in planning documents

According to Kristianstad Municipality, the coastal and maritime spatial planning plan considers sea level rise and coastal erosion as two big threats for the municipality, which encompasses the plan (Kristianstads kommun, 2019:66). The results from the plan showed that other climate adaptation measures were one of the most recurrent themes (see Fig. 5.1.). When discussing other climate adaptation measures than nature-based solutions and ecosystem-based adaptation, managed retreat was repeatedly mentioned. Furthermore, a combination of several strategies was often considered. In the discussion regarding nature-based solutions and ecosystem-based adaptation the two concepts are used interchangeably, which is why they are categorized as one theme. Moreover, the plan tends to discuss the concepts vaguely and in a broad context. The ecosystem approach (my translation of ekosystemansatsen) is defined as emphasizing the social and economic aspects of inclusion in sustainable development. In addition, Respondent A stresses the newness of the coastal and maritime spatial planning plan and claims that the development of the document is a step towards more inclusion of nature conservation aspects in planning. An example of this is Kristianstad's mapping of "no-go zones" unsuitable for further infrastructure development because of low-lying lands or sea level rise. Furthermore, the plan includes more long-term strategies such as revoking building rights. These aspects are something that is included in all

newer planning documents, which can be observed as an unconventional form of adaptation measure according to Respondent A (personal interview, April 9, 2021).

Respondent A (personal interview, April 9, 2021) also discusses the complex matter of legislations, old detailed development plans and building rights which are relevant aspects in regards to both coded documents. There are currently outdated detailed development plans and building rights in areas that are today deemed as “no-go zones” in Kristianstad. Since planning rules are only allowed to regulate what is unquestionably essential, this is a complicated political matter that is imprinted on the planning documents. Nature-based solutions and ecosystem-based adaptation have emerged as measures to mend this in combination with other strategies. However, both respondents furthermore confirm that there are no clear definitions of the concepts or discussion regarding discourse.

*“No, we probably don’t really have that [definition]. (...) It’s mostly the thought of like, this very sharp distinction - OK, hard protection measures are non-nature-based, everything else can be nature-based if one does it right. So it is more such a generalized distinction in between actually.”*

- Respondent A (personal interview, April 9, 2021)

Like the coastal and maritime spatial planning plan, the climate adaptation plan also frequently discussed other climate adaptation measures. Alternative adaptation strategies such as seawalls and technological fixes were additionally highlighted in this plan in contrast to the coastal and maritime spatial planning plan that primarily focused on retreat as a strategy. Furthermore, the climate adaptation plan comprehensively discuss Kristianstad’s previous adaptation measure, seawalls, and raises possibilities in developing the measure to optimize and further utilize what has already been implemented. Nonetheless, the discourse regarding nature-based solutions and ecosystem-based adaptation was not raised at all in the plan. Neither of the plans makes a distinct definition of any of the concepts and periodically uses the concepts interchangeably. Beyond this, the overarching content of both of the plans are fairly similar; the trade-offs and thus the pros and cons with certain adaptation strategies, using the terms nature-based solutions and ecosystem-based adaptation interchangeably, vague discourse regarding concepts and a focus on the fact that several aspects are intertwined and should therefore all be taken into account when producing a strategy for sustainable development. These mentioned aspects are the larger, underlying perspectives for both documents.

## 5.2 Implementing nature-based solutions

The results from the coastal and maritime spatial planning plan furthermore showed that trade-offs and challenges with climate adaptation strategies were two of the most recurrent themes (see Fig. 5.1.). Beyond discussing trade-offs between adaptation measures, the document also examined different values such as social, ecological and economic or other aspects such as national interests. The trade-offs were also considered as challenges in the implementation and planning process. Furthermore, there was a discussion regarding challenges that may arise when implementing specific climate adaptation strategies. The plan discusses the fundamentals and what to consider when implementing climate adaptation measures. It also examines what legislations and regulations that shape planning against sea level rise and coastal erosion. The coastal and maritime spatial planning plan does not explicitly review implementation but rather discusses the aspect intertwined with other themes such as trade-offs and challenges. The climate adaptation plan on the other hand, notably discusses implementation to a wider extent. Considering the aim of this plan is to discuss climate adaptation measures, this was fairly anticipated. In addition, other climate adaptation measures and challenges were also two themes that were frequently appearing in the document, which is more often than not intertwined with implementation. In the discussion concerning specific implementation measures, both physical planning and its preferred circumstances are analyzed. Results also showed that guidelines, frameworks and legislations that lay the foundation for implementation were also emphasized.

Even though the coastal and maritime spatial planning plan includes adaptation measures to some extent, it is nevertheless an extension of the comprehensive plan, which means that it is not binding. The aim of it is to provide a framework and guideline for detailed development plans. Nonetheless, Respondent A (personal interview, April 9, 2021) claims that in inquiries regarding detailed development plans, the mapped out “no-go zones” are often considered. Overall, several coastal municipalities have conveyed the need of a holistic approach by the state government to further municipal planning. Respondent B (personal interview, April 19, 2021), as an outside part in regards to Kristianstad, considers the municipality as ambitious in their work with sustainable development, ecosystems and improving biodiversity. Concerning LIFE Coast Adapt, Respondent B recounts that media attention is important in order to gain attention from the public. Furthermore, Respondent B discusses the fact that recently there has been a surge in coordination of knowledge from what have previously been fragmented projects. This has made implementation of adaptation measures in general more strategic

which is beneficial for municipalities' implementation strategies. State government urged municipalities to develop coastal and maritime spatial planning plans for instance in order for the state to be able to produce a plan on a national equivalent level.

*“It will be a factor, purely organizational, to coordinate the knowledge from what has previously been scattered on different downpipe projects down in enforcing organizations and municipalities to become more strategically comprehensive as one [municipalities] sees benefits (...) on assignments that purely concerns nature and climate adaptation.”*

- Respondent B (personal interview, April 19, 2021)

Respondent A (personal interview, April 9, 2021) also talked about the previously implemented adaptation measures in Kristianstad, such as seawalls and hard climate adaptation infrastructure. Because of the preconditions of Kristianstad, these strategies are necessary even though they often lead to further complications and are largely the opposite to nature-based solutions. Respondent A continues with discussing trade-offs following retreat as an adaptation measure and states that the strategy is complex both economically and politically. To further the work with retreat, national guidelines are needed according to Respondent A. National cooperation is something that Respondent B (personal interview, April 19, 2021) also states is essential in order to expand the work with nature-based solutions.

*“These seawalls that are supposed to protect the city, it is difficult to find something there that is purely nature-based/ecosystem-based. To be completely honest, (...) it is actually very unnatural to wallow in wetlands. But there are not a lot of choices. (...) to wallow in the city, reduce overflow areas (...) is not particularly nature adapted, rather the opposite. The seawalls can be worked with in different ways, to try to get them decent anyway, with different types of vegetation (...). But to say that it is something ecosystem-adapted, that, in fact, is not.”*

- Respondent A (personal interview, April 9, 2021)

Furthermore, in Respondent B's current work with the subproject Action C6 of LIFE Coast Adapt, the aim is to prevent coastal erosion and increase biodiversity, which is implemented by improving and restoring eelgrass meadows and building natural reefs. In Kristianstad, initial preliminary investigations regarding both eelgrass and reefs are completed, which has led to a decision to suspend the work with eelgrass. Nevertheless, it has been confirmed that LIFE Coast Adapt will proceed with the construction of a natural reef at Kristianstad whilst

Drömprojektet will continue working with the advancement of eelgrass. According to Respondent B (personal interview, April 19, 2021), the idea of working with nature-based solutions is associated with the strategy's cost-effectiveness and multifunctional abilities. The advantages with nature-based solutions are that they are implemented in the existing environment and can therefore integrate with the conditions of nature. In addition, they are beneficial for social values. Respondent A (personal interview, April 9, 2021) furthermore sees advantages since the measures are seemingly riskless and can result in long-term benefits. Nevertheless, Respondent A states that what would be most 'nature-based' is essentially to retreat and let nature run its course. Even though the strategies are considered harmless, implementing them does still mean that ecosystems are being somewhat manipulated. Therefore, Respondent A considers evaluation of implementation as being the most paramount part of all adaptation measures.

Both respondents agree that Kristianstad's vicinity to the ocean can be both an asset and a threat. Because of the low-lying land, coastal adaptation measures have always been necessary for the city's survival. The previously implemented measures have however caused further issues, such as at Evenemangsstranden with hard coastal infrastructure. This is why Kristianstad is slowly shifting to nature-based solutions as adaptation strategies. LIFE Coast Adapt has however met some difficulties along the way considering the scope and time frame of the project according to Respondent B (personal interview, April 19, 2021). The deadlines have led to restructuring and compliance of the project to meet the necessary time limits, this also results in a limited amount of resources for the evaluation process that could lead to inadequate conclusions. The evaluation part is something that moreover, historically has not been prioritized according to Respondent A (personal interview, April 9, 2021). Nonetheless, when discussing the discourse regarding nature-based solutions and ecosystem-based adaptation and implementation of the measures; Respondent B considers the concepts to be constantly changing.

*“It [nature-based solutions] has expressly been on the agenda for the last 40 years but new concepts are coined and angles and knowledge needs to be reinvented to describe what we are doing here and now. I think (...) the planning system is under retake now. There are many [municipalities] that are reviding, or actualizing or adopting new comprehensive plans, where this terminology will be a component.”*

- Respondent B (personal interview, April 19, 2021)

## 6 Analysis

This section aims to analyze the findings and compare the results gathered from secondary data in contrast to the data from the semi-structured interviews to discover similarities or differences. This section therefore begins with an overview regarding Kristianstad's projects with nature-based solutions - LIFE Coast Adapt and Drömprojektet. It will thereafter continue with a discussion concerning how the adaptation measures are considered in the planning documents. As the results have established, the municipality does not clarify their definition of either nature-based solutions or ecosystem-based adaptation. Moreover, in their planning documents, the concepts are either not mentioned or used interchangeably. Therefore an analysis of the discourse regarding this is also included. The conceptual framework of both of the concepts is furthermore also applied to either phrasing in the analysis. Lastly, the section will analyze the findings with links to Swedish urban planning.

### 6.1 Kristianstad's included nature-based solutions

Since Kristianstad is a coastal municipality, the sea can be considered both an asset and a threat. Because of the city's low-lying land, it has historically been compelled to implement coastal adaptation. Thus far, Kristianstad has implemented seawalls and hard climate adaptation infrastructures. This has however resulted in negative impacts on areas located nearby the implemented measures, which has led the municipality to seek strategies in other adaptation measures. As the results from the semi-structured interviews showed, Kristianstad is implementing projects with nature-based solutions, an alternative to the hard climate adaptation infrastructures. The projects include LIFE Coast Adapt and Drömprojektet according to Respondent A and B (personal interview, April 9, 2021; personal interview, April 19, 2021). The field of nature-based solutions can therefore be observed as steadily emerging in Kristianstad.

Drömprojektet aims to improve the environment around the bay area of Hane and recreate the biotope by further planting eelgrass. The project of LIFE Coast Adapt is nevertheless slightly different to Drömprojektet, both in terms of the purpose and execution. The project explicitly uses the term nature-based solutions and the purpose is to test different methods in several locations to assess what measure is most appropriate against coastal erosion and to facilitate the environment for biodiversity. Thus far, the fundamental comprehension of nature-based solutions are lacking since there are few specific examples of execution in terms of the strategy (Nalau et al., 2018). Available research mainly consists of smaller case studies that

are seldom generalizable (Doswald et al., 2014). This can therefore be argued as one of the reasons as to why LIFE Coast Adapt is designed with a large focus on the research part. Since the available research is not comparable to Kristianstad, LIFE Coast Adapt is conducting an individual study before fully implementing the measures. In this case, the initial stages of all strategies were tested on location, which resulted in the decision of proceeding with the building of a natural reef. Nature-based solutions have been proven as measures that are cost-effective, sustainable and synergistic, and the strategies are optimized when place-based decisions are made (Chausson et al. 2020; Debele et al., 2019; Ruangpan et al., 2020). Respondent B (personal interview, April 19, 2021) further supports this, as LIFE Coast Adapt conducts initial research in order to make an informed decision regarding what measure to implement at a certain location.

## **6.2 Adaptation measures in documents**

Considering the aim of the coastal and maritime spatial planning plan and the climate adaptation plan, discussions regarding different adaptation strategies are apparent in both. However, the details of said measures can be deemed as lacking in the documents since the specifics of LIFE Coast Adapt and Drömprojektet is not mentioned. The fundamentals of nature-based solutions and ecosystem-based adaptation are nevertheless referred to but never defined and furthermore discussed in vague terms. Moreover, other adaptation strategies such as retreat are discussed extensively in the documents but with an unclear conclusion (Kristianstads kommun, 2018; Kristianstads kommun, 2019). Adaptation measures can therefore be established as an evident and significant part of the planning documents. This confirms the aspect of “the sustainable city” discussed by Nyström & Tonell (2012:311-312). Environmental issues are one of the most emerging aspects in urban planning, and the municipality's focus and attention towards these matters in the development of current plans is a confirmation of this. Both plans are relatively new and the addition of the coastal and maritime spatial planning plan in 2019 is the first one of its kind (Kristianstads kommun, 2019). The amendment of the comprehensive plan can therefore be assumed as a result of changes in legislation, policies and guidelines (Nyström & Tonell, 2012:311-312). Respondent B (personal interview, April 19, 2021) furthermore stated that the state government strongly urged municipalities to develop this type of planning document to further their work on the matter. The fact that Kristianstad has the documents can arguably be seen as the municipality working more on environmental issues and climate adaptation efforts

than others, an opinion that Respondent B also shared (personal interview, April 19, 2021; SMHI, 2020b).

The dominating model in Swedish urban planning for a sustainable city is a holistic approach to development with a focus on place-based adaptation (Nyström & Tonell, 2012:313-315), which Kristianstad strives for with projects such as LIFE Coast Adapt according to Respondent B (personal interview, April 19, 2021). Nevertheless, the manifestation that can be observed in planning documents is a wide-ranging discussion regarding possible measures but no real specification or detailed information concerning how the strategies are going to be implemented. The mapping of zones that are unsuitable for further infrastructure development and long-term strategies in terms of revoking building rights can nevertheless be seen as more comprehensive measures for climate change but a holistic view of the matter in terms of state regulations is still needed for Kristianstad to further their planning according to Respondent A (personal interview, April 9, 2021).

### **6.2.1 Discourse of adaptation measures**

Furthermore the discourse between ecosystem-based adaptation and nature-based solutions is something that has been excluded to a further extent in this thesis but has been stated as the latter deriving from the former (Potschin et al., 2016). According to some, nature-based solutions include several different adaptation measures such as ecosystem-based adaptation and several other strategies (Cohen-Shacham et al., 2016), whilst others would argue that the holistic concept is ecosystem-based adaptation where nature-based solutions is a sub-subject (Potschin et al., 2016). Since both measures are relatively newly coined concepts and have not thoroughly been implemented and discussed in Swedish planning processes, the discourse was initially deemed as irrelevant. Further discussion of how the concept relates to one another has therefore thus far been omitted in the thesis. After examination of the coastal and maritime spatial planning plan, the climate adaptation plan and the transcript from Interview A, it has been concluded that Kristianstad uses the terms interchangeably. Furthermore, the concepts are sometimes adopted without an explicit use of the words whilst other times, the phrasings are utilized but not defined. Respondent A (personal interview, April 9, 2021) stated that the municipality does not have a definition of the concepts but rather employs the sharp distinction between hard coastal protection measures, deemed as non-nature-based solutions, and other measures. Every other strategy could therefore be potentially classified as nature-based if done correctly since differentiation between the strategies is fairly general.

The vagueness, or lacking of definition regarding the words could be analyzed as either effective or ineffective. According to Respondent A (personal interview, April 9, 2021), having no clear definition also means that strategies are not forced into fitting a certain model and therefore makes it more adaptable and flexible. This also paves way for further inclusion and creates possibilities for measures to be integrated as a nature-based solution. However, not having a description of how nature-based solutions relate to other concepts such as ecosystem-based adaptation could be argued as insufficient. Furthermore, using the words interchangeably could also be damaging. Consequences that may arise as a result of this could be that the concepts are essentially used as slogans without actually fulfilling the relevant criteria. In addition, when there is a lack of definition, other strategies could potentially be dubbed as nature-based solutions under false pretenses (Potschin et al., 2016). A discussion regarding the connection between ecosystem-based adaptation and nature-based solutions and how the concepts relate to one another is therefore needed in Kristianstad's documents in order to confirm that they are used accurately and to avoid negative outcomes.

Furthermore Respondent B (personal interview, April 19, 2021) discusses the newness of the concepts and the fact that they are dynamic and constantly evolving. New angles to the phrases are developed with the advancement of research. Municipalities are revising, actualizing and adopting new comprehensive plans, which Respondent B believes, will include this terminology. Kristianstad's coastal and maritime spatial planning plan is, as aforementioned, an amendment of the comprehensive plan (Kristianstads kommun, 2019), which can be argued as a step into a more climate change adaptation-based direction. Nevertheless, the planning document lacks the component of the proper terminology that Respondent B discussed. The novelty of nature-based solutions and ecosystem-based adaptation could be a reason for this since the concepts are still being molded and formed. However, the Swedish Environmental Protection Agency's release of the first national guideline for nature-based solutions in climate change could potentially change how municipalities dictate themselves (Naturvårdsverket 2021a; Naturvårdsverket, 2021b). A document with explicit phrasing could therefore shape how climate adaptation issues are being addressed according to Respondent B (personal interview, April 19, 2021).

In conclusion, the concepts of ecosystem-based adaptation and nature-based solutions are closely interrelated and have several similarities. IUCN defines nature-based solutions as measures that facilitate ecosystems while also focusing on societal issues, such as climate change, and have positive consequences for biodiversity (Cohen-Shacham et al., 2016).

Moreover, the CBD defines ecosystem-based adaptation as utilizing ecosystems and available biodiversity resources while taking social, economic and cultural aspects into consideration in order to assist nearby communities (CBD, 2010). When examining the definitions, they can arguably be regarded as relatively similar. Even though both of the approaches have historically existed, the terms are recently coined and definitions for each concept are still distorted. Potschin et al. (2016) therefore suggests that nature-based solutions are derived from ecosystem-based adaptation. Considering the amount of different definitions and how dispersed they are, the lack of clarification from Kristianstad's perspective is understandable. To address the discussion regarding the discourse could be a complex matter that would require time and resources in order to cultivate a proper, sufficient and knowledgeable definition. One thing that can be established, and is confirmed by several different studies is that there are significantly positive consequences of nature-based solutions and ecosystem-based adaptation which makes the measures favorable, but more research is needed regarding the subject to implement them to a wider extent (see eg. Chausson et al., 2020; Doswald et al., 2014; Nalau et al., 2018; Ruangpan et al., 2020).

### **6.3 Implementation of adaptation measures**

Adaptation measures that are going to be implemented in Kristianstad Municipality are, as previously mentioned, the building of a natural reef through the LIFE Coast Adapt-project, and eelgrass planting through Drömprojektet. Kristianstad is not a partner in LIFE Coast Adapt, but was requested to merely be a location to research for the project, which the municipality accepted according to Respondent B (personal interview, April 19, 2021). Furthermore, both Drömprojektet and LIFE Coast Adapt are funded by other organizations. The former is led and partially funded by WWF Sweden (Pearce, 2020) whilst the EU funds the latter and it is led by several government authorities such as county administrative boards and a selection of affected municipalities (Kristianstads kommun, 2020). Whether or not Kristianstad would apply these types of measures without the partnerships and external subsidies could therefore be discussed. The economic trade-off that is often considered with the discussion regarding implementation of adaptation measures is arguably one of the most important aspects. The majority of research concur that nature-based solutions and ecosystem-based adaptation needs further investigation (see e.g. Chausson et al., 2020; Nalau et al., 2018; Ruangpan et al., 2020). According to Cohen-Schacham et al. (2016) there are concerns regarding the cost-effectiveness of ecosystem-based adaptation. Since both of the municipality's projects involving nature-based solutions are in economic cooperation with an

additional party, lack of resources provided by external organizations could be presumed as a reason why the strategies have not been historically implemented in Kristianstad. Assets in terms of economic capital and knowledge were most likely inadequate and can explain why the strategies have not been previously implemented.

In LIFE Coast Adapt the concept of nature-based solutions are explicitly mentioned, which is the first time for Kristianstad according to Respondent A (personal interview, April 9, 2021). This could have paved the way for these strategies to further develop in the municipality's planning process. The starting point for nature-based solutions in Kristianstad could therefore be argued as rooted in the EU's subsidies. On the other hand, Kristianstad's Vattenriket is partly funding the measures in Drömprojektet. The aim of this project is nevertheless not to plan against climate change and sea level rise, but to improve the environment in the bay area of Hane. The fact that eelgrass meadows could act as a climate change adaptation measure and therefore a nature-based solution as a coastal protection strategy is as a result just an extra advantage (Respondent A, personal interview, April 9, 2021; Pearce, 2020). According to Kristianstad climate adaptation measures are a priority to the city (Kristianstads kommun, 2018), nevertheless, when examining the strategies, the municipality themselves seems to be, to a further extent, invested in projects with other purposes.

The results from researching obtained secondary data have moreover shown that the discussion regarding advantages and disadvantages are extensive. Both planning documents tackle issues such as trade-offs, challenges and necessary preconditions for implementing climate adaptation (see Fig. 5.1 & 5.2). Further specifics include the holistic perspective that Kristianstad deems crucial when planning against sea level rise (Kristianstads kommun, 2018; Kristianstads kommun, 2019), which is additionally considered crucial by Nyström and Tonell (2012:313-315). With the release of the national strategy for climate adaptation (Prop. 2017/18:163) and the Swedish Environmental Protection Agency's recent publication of the first national guideline for nature-based solutions in climate adaptation, the coveted broader perspective has furthermore developed (Naturvårdsverket 2021a; Naturvårdsverket 2021b). This is in addition manifested in the establishment of RKS, whose main purpose is to coordinate coastal issues in terms of sustainable solutions to manage challenges including sea level rise and coastal erosion (RKS, n.d.). Kristianstad are active in the dynamic work regarding these matters with spokespersons in RKS for instance (Respondent A, personal interview, April 9, 2021). Nevertheless, the formation of RKS and the publication of the national strategy and guideline are relatively new. How Kristianstad will furthermore manage

and implement the issue of climate adaptation measures with guidance from RKS and the documents therefore remains to be seen.

Another aspect discussed by Kristianstad is the previously implemented climate adaptation strategies such as seawalls. According to Respondent A (personal interview, April 9, 2021), the establishment of these strategies was initiated when it was deemed as utterly crucial. Because of Kristianstad's geographic placement and low-lying land, the municipality was compelled to implement measures that are contrary to strategies that are attempted and aimed for today. The seawalls were regarded as necessary for Kristianstad's survival at the time of implementation despite the disadvantages with them. Even though current knowledge has proven the negative outcomes with the adaptation measures, to remove or dissolve them today is considered too risky. An alternative is therefore to potentially develop and optimize them (Kristianstads kommun, 2018; Kristianstads kommun, 2019). In order for nature-based solutions to operate to their full potential, the measures should be place-based (Debele et al., 2019). This could however be argued as relevant for all types of climate change adaptation strategies. In this case, Kristianstad implemented seawalls when it was regarded as necessary with the research and knowledge that was feasible at the time, which resulted in seawalls and other hard climate adaptation infrastructure. This can be disputed as the then most optimal measure considering the location and the preconditions of the municipality.

Nevertheless, the design of the project of LIFE Coast Adapt and its focus on the research part can be explained by the fact that nature-based solutions and ecosystem-based adaptation are measures that have tangible constraints in terms of budgets which means that expanding, implementing, auditing and assessing the strategies are complicated and need further research (Nalau et al., 2018). Furthermore, since there is a lack of specifically Swedish perspectives on the matter and the conducted case studies thus far are generally smaller and led by local communities, this is deemed as unreliable and cannot be generalized and applied to Kristianstad's perspective (Doswald et al., 2014). Fundamental research is therefore needed at the location before committing and fully implementing a measure according to Respondent B (personal interview, April 19, 2021). An aspect to reflect on is whether Kristianstad would have initiated implementation of nature-based solutions and ecosystem-based adaptation without LIFE Coast Adapt. According to Nyström and Tonell (2012:311-314) the field of "the sustainable society" is emerging in municipality planning with climate related issues more highlighted during the planning process. In addition, the overarching perspective with sustainability and climate adaptation is incorporated to a greater extent, which can also be

confirmed when examining both the coastal and maritime spatial planning plan and the climate adaptation plan. Results however show that both plans primarily discuss different challenges and trade-offs and neglects specifics regarding implementation measures. The risk of using concepts such as nature-based solutions is therefore that the term is purely included as a slogan without further meaning to it.

In order to fully implement nature-based solutions and ecosystem-based adaptation, and to furthermore optimize the measures, specific policies are needed for them. Current regulations are not shaped for these types of strategies and can therefore at times interfere and complicate the implementation process. Therefore, the measures need to be legitimized and accepted by policy makers (Cohen-Shacham et al., 2016; Respondent B, personal interview, April 19, 2021). The publication of the first national guideline for nature-based solutions in climate adaptation is nevertheless a proof of the emerging field of alternative climate adaptation strategies (Naturvårdsverket, 2021b). Since the comprehensive plan should generally include strategic guidelines and describe how the municipality views their current situation and suggest plans for further development (Nyström & Tonell, 2012:163-166), the aspect of nature-based solutions should be included in this. Kristianstad's coastal and maritime spatial planning plan is an amendment to the comprehensive, which means that the issue should be raised in it. Even though nature-based solutions are mentioned in the plan, results showed that no details regarding specific implementation is discussed. The plan primarily discusses trade-offs, challenges and necessary preconditions. Furthermore, even though the aim of a comprehensive plan is to provide proper guidelines, it is not binding, which raises the issue regarding the effect that discussed matters in the plan would have in practice. In addition, Respondent A (personal interview, April 9, 2021) discusses other aspects that influence the planning documents such as political and economic trade-offs (Nyström & Tonell, 2012:163-166). Moreover, the different issues that need to be regarded are further recognition of the interdisciplinary approaches that lie within a successful planning process. Both respondents (personal interview, April 9, 2021; personal interview, April 19, 2021) also clarify the fact that cooperation is needed between different departments to get perspective on the matter. To make an informed assessment concerning how to implement nature-based solutions, an understanding of the intertwined matter is needed and the advantages and disadvantages are necessary to consider (Nyström & Tonell, 2012:316-317).

## 7 Conclusion

In conclusion the nature-based solutions that are included in Kristianstad's Municipality's planning are the LIFE Coast Adapt-project and Drömprojektet. The former aims to prevent coastal erosion and facilitate biodiversity with nature-based solutions, which is done by examining seven methods on five different locations according to Respondent B (personal interview, April 19, 2021). Stage one of test planting of eelgrass and the building of a natural reef has been initiated at Tället, Kristianstad (Kristianstads kommun, 2020) and it has been decided that LIFE Coast Adapt will proceed with the construction of the reef (Respondent B, personal interview, April 19, 2021). The purpose of Drömprojektet on the other hand is to improve the environment at and around the bay area of Hane by planting eelgrass shoots. The main goal of this project is not to use or implement specifically nature-based solutions or plan against sea level rise and coastal erosion (Pearce, 2020) but can be considered as an additional benefit. LIFE Coast Adapt is therefore Kristianstad's only included measure that explicitly uses the concept and phrasing of nature-based solutions.

When analyzing Kristianstad's coastal and maritime spatial planning plan and the climate adaptation plan it can be determined that the concepts of nature-based solutions and ecosystem-based adaptation are used interchangeably (Kristianstads kommun, 2018; Kristianstads kommun, 2019). The concepts are closely related and intertwined, and several definitions of them are considerably similar (see CBD 2009:41, 2010:3; Cohen-Shacham, 2016:xii), which can be argued as a reason to further emphasize a definition to avoid negative consequences. Kristianstad, however, does not provide this but furthermore lacks a clear presentation of the cases in their planning documents but rather discuss other climate adaptation measures, trade-offs and challenges. In general, details are fairly excluded in the municipality's planning documents but when included they comprise of for instance the mapping of "no-go zones" that are unsuitable for further infrastructure development and long-term strategies such as revoking formerly adopted building rights at potentially hazardous areas. Furthermore, beyond nature-based solutions and ecosystem-based adaptation, the plans include discussions regarding adaptation strategies such as retreat and potential development of previously implemented adaptation measures. In conclusion, no nature-based solutions have been implemented in Kristianstad; the only implemented measures so far are seawalls and other hard climate adaptation infrastructures. It has however been decided that Kristianstad is going to build a natural reef through LIFE Coast Adapt and plant eelgrass shoots through Drömprojektet. Furthermore, when discussing the concept of nature-based

solutions, the municipality has no definition of the issue and uses the term interchangeably with ecosystem-based adaptation. The plans largely discuss advantages and disadvantages to different implementation measures but rarely reach a conclusion or provide details regarding the practice, which can be criticized.

### **Suggestions for further research**

Since the field of nature-based solutions and ecosystem-based adaptation in Sweden are relatively new concepts that are emerging, there are multiple perspectives that can be further researched. First and foremost, research regarding specific measures that are included can be conducted, such as a specific study regarding the effects of eelgrass or a natural reef. This can be done through several perspectives such as social sustainability, analyzing it through the aspect of citizen participation or through a marine biology perspective to observe how it will alter the ecosystems and environment. Furthermore, legislation and regulations can be researched. Since implementation of these measures is new, municipalities and other practitioners have been met by difficulties that halt the process. An in-depth analysis of concerned laws and statutes is therefore needed to potentially facilitate for municipalities.

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## Interviews

Respondent A. (2021, April 9). Personal interview. Employee at Kristianstads kommun.

Respondent B. (2021, April 19). Personal interview. Employee at Skånes Kommuner.

## Appendix A: Interview guide A

Introductory questions:

1. What does your job description mean? How long have you had this role?

Climate adaptation measures:

2. What kinds of climate adaptation measures have Kristianstad previously implemented?
3. What is the reasoning behind the shift from hard climate adaptation structures to nature-based solutions?
4. What projects do you currently have that include nature-based solutions in regards to rising sea levels?
  - a. Can you tell me more about LIFE Coast Adapt/Drömprojektet?
5. What are Kristianstad's future-plans for nature-based solutions? Any more specific plans?
6. How was the trade-off when determining between nature-based solutions and other climate adaptation measures? Why nature-based solutions?

Presented in documents:

7. How are nature-based solutions presented to the general public?
8. Are nature-based solutions defined, or even mentioned as a concept in Kristianstad's planning documents such as the coastal and maritime spatial planning plan and climate adaptation plan?
  - a. Do you see a difference in theory versus practice in using the concept?

Nature-based solutions:

9. How are nature-based solutions defined?
10. What are the advantages/disadvantages when working with nature-based solutions?

## Appendix B: Interview guide B

Introductory questions:

1. What does your job description mean? How long have you had this role?
  - a. What does your job mean in relation to LIFE Coast Adapt in Kristianstad?

LIFE Coast Adapt:

2. Can you tell me about LIFE Coast Adapt through Kristianstad's perspective?
3. How is the project presented to the general public?

Kristianstad Municipality:

4. As an outside party working with Kristianstad Municipality, how do you see the municipality involving measures such as nature-based solutions in its planning?
5. Do you see a difference in how Kristianstad applies the concept of nature-based solutions compared to other municipalities?
6. What is your experience with municipalities using the concept of nature-based solutions and ecosystem-based adaptation, if at all?

Nature-based solutions:

7. How come Kristianstad, or municipalities in general, are shifting from hard climate adaptation measures to other strategies?
  - a. How do you experience the trade-off between nature-based solutions and other adaptation measures?
8. How do you define nature-based solutions?
9. What are the advantages/disadvantages when working with nature-based solutions?