Executive summaries of Regional Integration Project 2023

Utrecht University

Bachelor Global Sustainability Science

General introduction

In the 1st year course Regional Integration Project students from Global Sustainability Science (GSS) studied a wide range of topics regarding sustainability issues on Texel. The four overarching themes were (1) Nature management and recreation, (2) Water and Salinity, (3) Imagining futures for Texel and mobility, and (4) Renewable Energy. The students applied mixed-methods and studied ecological aspects and social aspects underlying these issues. In this document, you can find executive summaries of the obtained results.

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1. Nature management and recreation

1A: Tourism and nature management

1A Alpha: Views on light pollution in Texel: To what extent are different stakeholders on Texel willing to tackle light pollution?

This report explores the willingness of various stakeholders on the Dutch island of Texel to lower their light emissions and the barriers that prevent them from taking action. A review of some of the available literature provides insights into the effects of light pollution in nature and a conceptual framework for understanding the drivers of pro-environmental behaviour. The information presented in this report has been gathered from conducting interviews in Texel with various Stakeholders such a hostel manager and an entrepreneur, as well as a representative from the National Park and the municipality of Texel. The research revealed that the stakeholders interviewed lacked comprehensive understanding of the specifics regarding light pollution, however despite that they made efforts to reduce their usage of light. The incentives for these actions were mostly economic and ecological; such as those in the hospitality sector seeing potential profit in reducing light pollution, or the general ecological mindfulness of the Stakeholders encouraging them to make sustainable choices.

However, despite the effort currently taken by the Stakeholders to reduce light pollution, the research identified various barriers that hindered further actions. These barriers include economic obstacles, public safety and the aforementioned lack of extensive knowledge about the consequences of light pollution. To address these barriers, the report suggests raising awareness about light pollution and the benefits of reducing it. The report will encourage policy changes aimed at providing incentives to Stakeholders to lower light pollution, raising awareness about the consequences of light pollution through campaigning and education, and developing safety measures to keep people safe in the darkness to remove hesitation regarding removing lights at night.

The report has been prepared for submission as part of the course “Regional and Integration Project” of the Global Sustainability Science Studies Course at Utrecht University.

1A Beta: Ecotourism on Texel: barriers and potential

The growing demand of tourism on the island of Texel in the Netherlands is a threat for biodiversity as well as the landscapes of the island. Any touristic activity that sheds light on nature conservation is considered ecotourism, some synonyms for this word are ecological tourism, sustainable tourism, etcetera. Ecotourism is of great importance for the island, as most natural areas depend on tourist behaviors. Many stakeholders have different interests when it comes to tourism and biodiversity conservation. Therefore, this research conducts interviews with different sectoral stakeholders, to understand the different barriers that may be limiting ecotourism on Texel. Previous research has mentioned how “Texel became an object for nature conservation as well as tourism”, and other papers have discussed the different barriers that exist to date limiting ecotourism, of course, for each case it is different. To retrieve data interviews with different stakeholders were conducted, all the stakeholders were from different sectors: government, animal conservation and academia and more. Following the interviews, they were transcribed and coded into five main categories that envelop the framework of this research: willingness of community to participate, market demand, site and infrastructure, socio-economic linkages to biodiversity conservation, and tourism impact. Consequently, finding all the valuable information that could be used to highlight the barriers and potential of Texel. The main findings in this research are three among the stakeholders views, mobility is mentioned as a priority for the stakeholders, each stakeholder has different focus for the socio-economic linkages to biodiversity, finally, the trade-offs that exist within sustainable nature conservation.

1B: Views on nature

1B Alpha: Views on nature and their implications with the current nitrogen crisis

This report examines three types of views on nature and their involvement in the current nitrogen crisis in the Netherlands, focusing on the residents of Texel. More specifically, it concentrates on the following research question: How does the individual view on nature of farmers and other residents on Texel influence their opinions on the government's regulations regarding the nitrogen crisis? The research was conducted with an emphasis on farmers from Texel as they are directly impacted by the nitrogen crisis and other Texel residents to discover possible divergences in opinions based on their relationships with nature.

The nitrogen crisis is a current issue that started after the State Council of the Netherlands had decided through a high court decision to diminish the use of nitrogen. This led to strong disagreements between the farmers with the government regarding their decision on nitrogen use, which was expressed through various protests. This report establishes that views of nature influence behaviour towards nature. Thus, by studying and analysing the relationship between the two elements it is possible to deduce how members of the Texel population with different views expect the government to handle the nitrogen crisis differently, as, depending on the types of actions taken, nature will be impacted differently.

Analysis of the data collected as part of the survey has led to a number of findings regarding this topic. The most important ones can be summarized into three points. First, more than half of the Texel residents that did the survey (35) have a relational view on nature, 13 residents have mixed views on nature, 10 others have a complex coupled system view on nature and only 2 have a modernist view on nature. The vast majority of the farmers that answered the survey, besides one of them, have a relational view on nature (mixed with another view on nature or not). From there, it can also observe that the ones that only have a relational view want the local government to be responsible for making regulations. Then, the majority of the residents believe that the nitrogen crisis should be handled on the national level. Furthermore, they believe that a Sustainable Agriculture Conversion Program for farmers interested in changing to circular agriculture is the overall best option to reduce nitrogen emissions. Finally, the views on nature and views on nitrogen crisis seem to have a connection with the farmers. However, in order to confirm this, further research needs to be done.

This research can be found useful for the State Council of the Netherlands as well as for the Texel municipality. Indeed, in order to successfully improve the sustainability challenge currently faced in Texel, it is important to understand the public's opinion to know which path would be the best to take to handle such a situation. Furthermore, from this research, the conclusion was that conversion programmes such as the sustainable agriculture program is favoured by the Texel residents. Therefore, through this research it is recommended that this type of action requires more emphasis put on.

1B Beta: A review of the views on nature of Texel's stakeholders in relation to nature protection policy

Purpose of report:

Texel's unique natural environment draws approximately a million tourists every year, meaning the island is dominated by those who come to visit. With its popularity, the environment is doomed to bear the consequences of people's actions. The way people treat Texel's nature, depends on their view on nature and their values. Understanding how people see nature can serve as a medium to determine the best course of action. Thus, the purposes of this report are as follows:

- Establish how much the nature protection policy of Texel fits with the views on nature of tourists and residents
- Determine how this view can be improved to promote cohesion between society and nature protection policies

Methods used:
A survey was administered to assess the current views on nature of different stakeholders, including both tourists (subgroups: nature-motivated and entertainment-motivated) and residents (subgroups: farmers and other residents). A total of 70 responses were examined through SPSS.

The materials used in the research were limited, but several ways of approach were applied. Tourists as well as residents were approached, through public spaces such as monuments, parks or cities, going from door to door and visiting farms. To reach all target groups/stakeholders, as many locations on the island as possible were visited, such as Eyerland, Oudeschild, the Koog, the ferry, Den Hoorn and Den Burg.

Findings and conclusions:
The report brought forth several insights on people's views on nature and many factors or different questions were compared to find possible connections. The most clear and vital findings that this report highlights are the following:

- In the 5 views on nature, the most chosen views were the developmental view, with 38.24%, and the coevolution view, with 30.88%. If we look at only the answers from farmers, the classical view is also popular. Inhabitants tend to choose the hands off view more.
- In the plot type of respondents vs views on economic development, tourists primarily chose ‘somewhat agree’, while inhabitants (despite mostly agreeing), were more divided.
- Tourists are generally more positive about the effectiveness of the current nature protection than inhabitants.
- Both tourists and inhabitants value nature highly, but tourists relatively claim to have a higher appreciation for nature. Inhabitants indicated they also value other working sectors on the island.
- In the chart ‘overall view in effectiveness of nature protection on Texel’, 45.45% answered moderately effective and 16.76% chose even less effective, meaning the overall majority is not positive on current policies.

Recommendations:
Some findings suggested the satisfaction with current policies is not nearly optimal. Current nature protection is not achieving its desired level of effectiveness. In addition, there is a tremendous gap in view between the inhabitants and tourists due to a lack of communication and information exchange. Substantial changes need to be implemented to overcome these obstacles, starting with the municipality revisiting current policies.

1C: Views on bird paradises on Texel

1C: Views and opinions on the bird paradises on Texel: Focusing on local residents and tourists
The main objective of this study is to examine the extent to which residents and tourists have different opinions on bird paradises on Texel. A research question was used as the main guidance to the solution of this issue: “To what extent are there differences of opinions between residents and tourists on the expansion of bird paradises on Texel?” These conservation zones, or "bird paradises," aim to protect the island's native birds. It is imperative to include both stakeholders' perspectives while discussing the extension of these conservation zones, since birds significantly impact the

island's economy, as well as the living standards of the population (NH Nieuws, 2018). Along with their importance in the economic system of Texel, birds are essential for the wellbeing of the ecosystem and its sustainability.

Data was gathered through a survey that was carried out around the island, including at De Koog, Den Burg, and the ferry that connects the mainland to the island. The results showed that locals and tourists have similar opinions on multiple fields. For instance, the two groups consider it crucial to preserve present bird paradises, and that the preservation of biodiversity ought to be the primary concern for the government of Texel. Although there are several analogies between the perspectives, there are also considerable discrepancies, particularly in relation to the extension of bird paradises. In fact, it appears that locals tend to disagree more frequently than tourists, who are inclined to be neutral or agree with the expansion project. Additionally, it appears that locals disagree with the idea that bird paradises would benefit the island, compared to tourists who seem to more frequently agree with the statement. This suggests that the municipality should consider the divergent viewpoints of the two stakeholders when deciding where and how to extend these zones. The administration of Texel must take into account all potential ethical and environmental implications since the growth of bird paradises is still in doubt. Hence, the findings are intended to assist the municipality's decision-making on the growth of these areas in order to satisfy all stakeholders and preserve the environment

1D: Herbivores and biodiversity

1D: The Influence of Herbivore Grazing on Plant Biodiversity and Abundance in Dune Valleys on Texel, the Netherlands

The dunes of the Wadden Island Texel, the Netherlands, are part of National Park Nationaal Park Duinen van Texel and are protected by, among others, the European initiative Natura2000. The aim of Natura 2000 is to preserve biodiversity. To achieve this aim, the municipality of Texel set up a nature and landscape conservation plan for Texel including eight goals, with the most important one being to maintain the openness of the landscape on Texel. In order to reach this goal, there is a need of consistent managing and monitoring of plant abundance and plant species in order to prevent plant succession – where an open landscape becomes a forest and threatens the ecosystems of the dunes. The current vegetation managing in Texel consists of mowing in or introducing grazing herbivores to the dune valleys. However, there is not much scientific evidence of the impact that these introduced herbivores have on the plant biodiversity and plant abundance.

Therefore, considering this knowledge gap and the goals of Natura2000, the aim of this research was to observe and measure the influence grazing herbivores have on plant biodiversity and abundance in the dune valleys and compare this to other types of vegetation management methods. This research was conducted in De Bollekamer), De Geul and Bleekersvallei where the collected data aimed to measure and calculate the following variables: plant height, biodiversity, evenness (E), and biomass. De Bollekamer was a location with managed cattle grazing; De Geul was a location with unmanaged geese grazing and a managed rotational cattle grazing; and Bleekersvallei was a location where ocasional sod-cutting and choppering took place.

According to the results of this research, there is no significant difference in mean plant hight and in the dried plant biomass between the three locations, De Geul has a significantly higher biodiversity index compared to the other two locations, and De Bollekamer has a higher E compared to Bleekersvallei, while the E for De Geul is not significantly different from the two locations. Considering these findings and the aim of the research, it can be noted that De Geul had the highest biodiversity, but it is hard to say that this was due to unmanaged grazing by geese as other factors,

such as soil fertilisation by bird poop and a stronger wind at the location, could have had a greater impact on the plant biodiversity. More data measuring is needed to confirm or get more accurate findings, as the research was conducted on a total of nineteen plots. Therefore, it is recommended to consider this research as an observation and basis for further research, which could then be used as a basis in designing guidelines for sustainable grazing that keeps the biodiversity preservation, or promotion, in mind. Additional recommendations based on the results are to conduct longitudinal research in the areas De Geul and De Bollekamer, and a policy that implements rotational grazing in Bleekersvallei.

1E: Forest management and biodiversity

1E Alpha: Forest Management and Biodiversity

In Nationaal Park Duinen van Texel, there is a forest called De Dennen. A part of that forest was rewetted in the 90's and another part in 2001. Both were rewetted with the ambition of having more biodiversity and a bigger fresh water reserve, among other reasons. In this report we looked at the difference in undergrowth biodiversity in the two rewetted areas compared to one non-rewetted area. Our main research question is as follows: How have rewetting efforts on the Island of Texel increased the biodiversity of the forest floor measured in the species richness of plants? In recent years there is more research being done about rewetting. This analysis mainly focuses on peatland and wetlands. Similar research has been done in Texel regarding the dune valleys. However, the rewetted forests are rarely investigated, particularly in Texel. The research that has been done usually looks at the trees themselves. Rewetting is said to be good for undergrowth in a forest (Olsthoorn, 2003). The reason we are looking at biodiversity is because it is important for the ecosystem services, it indicates the health of the forest and it makes it more resilient to storms and other natural disasters. We were given a map with three areas of land of which apparently two of them were rewetted. In all three areas, eight one by one meter sized plot samples were done. In those samples we looked at the amount of plants and the number of different species.

Conclusion:

There seems to be no difference in biodiversity between rewetted and non-rewetted parts, but results are not statistically significant. On the other hand there is also no real variation between the two rewetted areas in terms of biodiversity in the undergrowth. The results we acquired are not statistically significant. This insignificancy is caused by having too little measuring points. The current nature management strategy of rewetting did not lead to any increase in biodiversity of the undergrowth in the two areas analyzed. The difference we observed is most likely caused by abiotic factors, such as sunlight. Thus, a different technique or management strategy needs to be implemented if biodiversity needs to be increased in the area.

1E Beta: The effect of rewetting on the biodiversity on Texel

This research paper focuses on tackling biodiversity loss through rewetting. The research is situated in de Dennen forest on the island of Texel, located in the Wadden Islands archipelago. In the early 1990's a disbalance was noticed in the water table of the peatland forest "De Dennen" on the Island of Texel, the Netherlands. Due to this, the forest area displayed a decrease in its already frugal biodiversity, consisting of monocultural pine trees. To resolve its low biodiversity problem, the municipality and water authorities constructed waterways throughout the area, initiating a rewatering project named "de Tureluur". Since 1995, the project increased in scope, and more waterways were created, now also containing the "Bleekerij & Ploegelanden". To increase biodiversity even more, deciduous trees were planted in order to prevent the dehydration of the soil. However, the project did not seem to have focussed on the results of the rewetting, as papers, articles and documentation were missing. This knowledge gap was something to be researched over

the course of our stay on Texel. Therefore we state the research question as follows: Has rewetting forest areas in Texel been an effective forest management tool in increasing biodiversity today?

In order to examine the differences in biodiversity of rewetted and not rewetted, three main location were marked to conduct the research: two rewetted areas, and one area which was not rewetted, acting as a control area. In the course of three days, a total of 25 plots of one square meter were examined for species richness, diversity and abundance. To numerically classify each plot, two indexes were used; the Shannon-wiener index, and the Simpsons index.

The research was tested on significance using the Mann-Whitney U test. This test showed that the Shannon-wiener index displayed significant results, while the Simpsons index was less trustworthy; results using this index could have been caused by chance. Despite that one of the indexes did not significantly display correlation, both indexes displayed similar results on a box plot. The rewetted areas showed a Shannon-wiener index of an average of 1.35, versus the 0.82 displayed by the control area. These values are not on a scale, which makes it difficult to show relativity amongst the values. The Simpson's index is scaled from 0-1, for which 1 indicates a high biodiversity. The Rewetted areas showed a Simpson's index of an average of 0.63, versus the 0.49 displayed by the control area.

Despite the insignificant values of the Simpson's index, they do not contradict the values of the Shannon-Wiener index. The Shannon-Wiener index is significant and can be drawn to the foreground, showing that there is a higher biodiversity in the rewetted areas. Therefore, it can be said that rewetting has a regenerative effect on increasing biodiversity. This makes rewetting an effective forest management tool for increasing biodiversity.

For future policy recommendations, the results of this research suggest that rewetting is an effective tool to increasing the biodiversity of an area. When trying to gain biodiversity in a peatland area, rewetting should be considered as a serious option.

1F: Nature management and carbon storage in forests

1F Alpha: Optimizing carbon storage in forests on Texel, the Netherlands

The problem:
This research paper aims to investigate the correlation between biodiversity and carbon storing capacities of forests in the Dennenbos on Texel. The research question is "Does increased biodiversity in tree species on Texel increase the carbon storage as opposed to the homogeneous forests?".

Background information:
The Dennenbos was planted in the 19th century for wood harvesting purposes, today however the main purpose of the forest is recreation and tourism (VVV Texel, n.d.). Forests are capable of capturing CO2 from the atmosphere and storing it, making it an asset in the fight against climate change (Harris & Gibbs, 2021). As climate change becomes an increasingly bigger threat, our research aims to investigate if the Dennenbos also can act as a carbon sink. The island of Texel is currently in the process of planting more tree species in Dennenbos to enhance biodiversity, and this research could act as a guideline to combine this aim with increasing the forest's carbon storage.

Main findings:
Most of our data analysis showed insignificant relationships between the different variables. This could be because there is no relationship between biodiversity and carbon storage, but most likely it is because the research still is in its early stages: The data collection needs to be more extensive and include larger and more samples and the research cycle needs to be repeated several times.

However, the research did conclude that the individual tree species most efficient in storing carbon was the black pine, followed by the oak and the European beech.

Policy recommendation:
Since Texel is in the process of replanting the Dennenbos and improving the biodiversity we recommend them taking the opportunity to do more research on how to combine this with turning the forest into a carbon storage. Our research can act as a first steppingstone since research often has to be repeated many times before valuable conclusions can be drawn. With more time and resources, factors that improve carbon storage of a forest can be researched. However, our research can already recommend planting black pines and large deciduous trees with thick stems such as oak and European beech - to what extent and in what combination is still unclear though.

1F Beta: Nature management and carbon storage in forests
1.1 Purpose of research:
The purpose of this research is to find forest management strategies that increase the carbon content of the De Dennen forest on Texel. This is important with the background of a warming climate that will cause numerous disruptions, caused by increased carbon dioxide (CO_2) levels in the atmosphere.

The research questions that guided the research are about how the characteristics of forests, tree age, tree species, and forest density maximize carbon storage; and further how those characteristics can be used in the forest management on Texel to increase carbon storage.

1.2 Methods Use:
In 31 five by five metre plots in the De Dennen forest on Texel, all trees were counted, identified and their circumference at breast height was measured. For the calculations of tree age and carbon content of the tree, the circumference and species characteristics were used. Afterwards, the characteristics of the data were analysed, and relationships were identified. The relationships encountered graphically were statistically tested.

1.3 Findings and Conclusions:

1. Tree age Older trees were found to store more carbon. The relationship between tree age and what type of forest they were observable, but not significant, which was due to too low sample size.

2. Tree species Tree species with a higher wood density store more carbon per basal area than lower density variants. Also, trees that grow taller store more carbon, like pine. There is a significantly lower number of species and subspecies in pine areas than in deciduous and mixed stands.

3. Forest density There was a significant positive relationship between the tree density in the forest and its carbon storage. Looking at average carbon stored per tree, the carbon content in trees was higher in parts of the forest with a high basal area.

4. Total carbon stored The total carbon stored, according to the limited calculation used in De Dennen is approximately 108 kilo tonnes carbon, over an area of 3.6 km2 . 3

1.4 Recommendations for improving carbon storage in De Dennen forest:

1. Letting the forest grow older An important strategy in increasing the carbon storage in the De Dennen forest is to ensure that the forest grows as old as it can. Most carbon is currently

stored in young trees because there are more young than old trees. Since the carbon storage increases with tree age, it is recommended to ensure the aging of the forest.

2. Increase resilience A healthy forest is best at capturing carbon. Climate change could become a threat to the health of the forest. It is therefore recommended to increase its resilience by increasing its biodiversity. Further research into the future risks of climate change could be a long-term valuable investment in preparation for droughts, disease, and wildfires. There are currently no forest management practices in place that are focused on carbon storage (Appendix E). Monitoring and maintaining the forest can help in the protection of healthy and productive trees.

1G: Breeding birds on newly created inland-wetlands

1G: Breeding birds on newly created inland-wetlands

The study aims to investigate the relationship between wetland size, degree of development, and the number and diversity of bird species present, with a focus on wetlands. The findings of this research could be used to gain a better understanding of the relation between the wetlands and breeding birds of Texel. Thich could be used in recreating the conditions that are found optimal for certain species for conservation efforts. The study begins with a literature review related to wetland size, development, and variety in bird species. The research methodology includes quantitative data collection bird observing using binoculars during the Texel trip. Five sampling areas on Texel were chosen in advance, including Utopia, De Petten, De Horsmeertjes, De Hors, and De Bollekamer. Additionally, data from wildlife management stakeholders and bird watching clubs were used to fill in some informational gaps that were not answered by the fieldwork. Geographic Information Systems (GIS) and mobile apps were used for area measurements and plant species identification.

Bird species present in the wetlands were identified using a bird guidebook, called “Vogels of Texel”, and binoculars. All observed bird species were recorded in specific areas to analyze the correlations between bird presence and wetland characteristics. The collected data on plant height, diversity, and bird species were organized in an excel spreadsheet for a clearer analysis. Statistical analysis using SPSS software included Shapiro-Wilk tests for normality and Spearman’s R tests for correlations. The results from these tests were Afterwards used to help formulate reasons as to why some species were or were not present in certain areas. The results section presents the findings from the analysis of bird variety, diversity, and degree of development data for each location. charts such as bar charts, pie charts, and scatter plots illustrate the findings in a comprehensive way. The analysis provides insights into the distribution of bird species and their relations with wetland characteristics.

Overall, this research contributes to the understanding of bird numbers and species diversity that reside in wetlands on Texel. The findings can help with possible bird conservation in the future as they show what landscapes and vegetation have positive or negative effects on the bird species on Texel. By understanding the correlations between wetland characteristics and bird presence, future policies can be made by informed decision making to reduce biodiversity loss and improve human-made and natural wetlands. In conclusion, this research tries to fill a knowledge gap regarding the relationships between wetland characteristics and bird species abundance and diversity.

2. Water and salinity

2A. Best solutions according to farmers

2A: Water salinity and water scarcity on Texel

In this report an answer to the research question: 'What are the incentives for farmers of Texel to adapt their current agriculture practices to water salinization problems?' will be found. This research question is of importance since freshwater shortages and water salinization are a growing problem, especially on Texel because the island is on all sides surrounded with salt seawater. The shortage of fresh water negatively impacts the agricultural sector in their irrigation, crop yield and food production. When the answer to the research question is known, action can be taken towards a more beneficial way of crop cultivation avoiding the problems of fresh water shortages and water salinity. To answer the research question data will be collected through several semi-structured interviews with farmers on Texel. To understand the incentives of different farms, there will be a collection of small- and large-scale farmers interviewed, 4 in total. Their incentives might differ since their capacity and situations also might differ.

The interview questions are about the background, current practices and visions of the farmers for their own farm. The goal is to find, with these categories of interview questions, the different types of incentives that the farmers can have. The answers of the farmers will be transcribed and uploaded to NVivo. In NVivo these transcripts will be coded into the different categories: background, current practices and visions. These categories are coded into sub-codes to be more precise. ''Background'' has sub-codes: ''Types of crops'', ''Scale'' and ''Current measures''. ''Vision'' has sub-codes: ''Vision on current situation'' and ''Vision for the future''. These codes serve as evidence for the incentives of farmers. With the coded files, links will be made between the coded data and will be visualized in figure 2.

In our results we found that a link can be seen between background and current practice. This is because large scale farms can afford more expensive machinery. However, the small scale farms operate on a smaller area of land and are far more experimental in their methods. This implies that their aims are different as well, as the larger-scale farmers said that their big profit margins provide them the freedom to experiment and make mistakes or have a poor crop. The other two farmers, on the other hand, invest a substantially larger proportion of their money and resources on a single crop. Although the aims and scales of the farms are different, the farmers are all set by the same rules. Most of them also talk about these regulations. However, they do not seem to mind these rules. One farmer even stated that he would not start with irrigation if this was made legal on Texel. This has to do with their vision, farmers do not see salinity as a major issue because they have adapted to it or have the luxury to be experimenting and expertising in salt resistance. Sweet water shortage seems a bigger concern, however, both large and small scale farms seem well prepared for this. For further research it could be interesting to interview more different farmers and other actors.

2B: Possibilities for fresh-water storage

2B Alpha: What are the perspectives of farmers towards the 'Zoete Toekomst Texel' project, and to what extent are they involved in the decision-making process of the water management authorities?

Texel is a Wadden island in the Netherlands in the province of North Holland. The island has no rivers or lakes and is because of that completely dependent on rainfall and tubes connected to the mainland. The farmers on the island struggle with dry periods and because of these freshwater shortages.

The project 'Zoete Toekomst Texel' could be a permanent solution to this problem. They plan to instal underground storage systems to collect and store rainwater during wet winter months than can be

used in dry summer periods. If the project is successful it can save up to 7 million cubic meters of fresh water annually. However, it is crucial to consider the perspectives of the farmers and their involvement in the decision-making process. The research aims to find these different opinions and to show what the decision-making process has been like.

This report presents a couple findings on the 'Zoete Toekomst Texel' project. There are diverse perspectives of stakeholders being explored, the concerns, motivation, and overall acceptance on the project. The level of which the farmers are involved in the decision-making process is also analyzed and integrated into the project.

In the literature review the importance of effective communication in being highlighted in stakeholder management. Possible deficiencies have been identified in the research, with some farmers claiming they have been informed, and others having no knowledge of it at all. The farmers who are directly involved in the project itself do claim that the communication regarding the project is sufficient. While the farmers who live further away have received less information about it.

The water management authorities are monitoring and funding research to improve the storage units in the future. The aim is to make the storage units more cost-effective and efficient with the help of new technologies. If the pilot is deemed to be a success, the aim is going to be to increase the number of storage units, helping more farmers through dry summers.

The interviewed farmers have raised some concerns, especially regarding the financial feasibility of the project for smaller or less wealthy farms. The farmers have voiced concerns about salinization and milk cow farms, as they don't suit the project due to their specific characteristics.

Overall, the discussion highlights the importance of effective communication, the need for inclusive stakeholder engagement and the challenges of making the project 'Zoete Toekomst texel' accessible and inclusive.

To conclude, farmer's hold differing opinions on the project. While some feel well-informed and involved in the project, others feel excluded due to lack of (financial) accessibility and communication. In the future, flow of information between stakeholders should be improved and action should be taken to make the project more accessible to farms with different farm-types and financial situations.

2B Beta: Possibilities for fresh-water storage on Texel

Many of the issues revolving around the environment nowadays are the result of human mismanagement of nature and climate change. Texel is no exception to this, as they are an island surrounded by salt water, one of their greatest concerns is its diminishing freshwater availability, farmers and other companies have been dealing with increasingly long-lasting dry periods, because of the irregular precipitation patterns. These dry periods often result in farmers losing their crops and the groundwater levels dropping to concerning depths. Additionally, farmers have been pumping fresh water into the sea to be able to use their land for crops, resulting in an even larger shortage of fresh water on the island. The combination of these factors has made it unsustainable for the island to continue this way of managing its fresh water.

This research project has set out to find suitable solutions and possibilities for sustainable freshwater storage on Texel. We have been engaging in conversation with some of the parties who have been "mostly" affected by this issue, to discover what they think are viable solutions and to get a grasp of their unique perspectives, as residents of Texel, on this matter. We conducted the research by holding semi-structured interviews to collect qualitative data. In order to give direction to the

research, we formulated the main research question upon which the research has been built: “What are the most suitable techniques for freshwater storage on Texel that can enhance water availability for agricultural activities while considering factors such as water quality, sustainability, and economic feasibility?”. From these interviews, we have collected our main findings.

The conclusion that was reached is that the most hopeful initiative is Zoete Toekomst, a cooperation proceeding between different stakeholders where a combination of communication and perseverance results in a positive outcome. Additionally, there are other initiatives we visited and investigated, those were: salt farming, ordinary agriculture with saline water of a certain concentration, treating wastewater, handling agricultural processes with some degree of purification, and a combination of floating solar panels on the locks along with water tank storage done by stows in streams along the piece of land.

Furthermore, by speaking to stakeholders themselves directly we gained insights in communication and economic feasibility. Nearly all farmers and companies are proposing clearer communication from the waterboard and local municipality. Regarding upcoming projects economic feasibility are still a difficult matter. Without subsidies, they are too expensive for individual stakeholders, therefore, gaining the goals of sustainable water storage is limited at the moment. For further research, the affinity of water systems with energy generation may create a visible opportunity for self-sufficiency. When creating new policies and altering current ones, components such as transparency and proportionate consensus should be on the agenda.

2C: The problem of surface water salinification

2C Alpha: Residential and Touristic Awareness of the Salinification of Texel’s Groundwater

This research was in collaboration with Texel Island and Utrecht University on a research project to gather information about Texel and plan its future. The focus was on water salinity, as the Netherlands' low-lying lands are vulnerable to sea level rise, leading to flooding and seawater intrusion. This intrusion of seawater into land can cause the water to be more saline and makes the water unsuitable for drinking and agriculture. The research question belonging to this report is: To what extent are residents and tourists aware of the increasing salinity of Texel's groundwater?

Texel is one of the places that could easily be observed because it is surrounded by water and therefore the water plays a significant role in the ecosystem of Texel. In order to comprehend the current level of knowledge on salinification and its effects, a thorough literature review was first carried out. This literature review emphasised the need of addressing the issue and the crucial need of public awareness for improvement of this issue. Therefore, quantitative surveys were conducted of residents and tourists on Texel to gain information about the awareness of the two groups. This survey included general questions, questions about water salinity, and questions about the awareness of water salinity.

The findings of the survey have helped with better understanding the awareness of the issue impacting Texel and its community. The findings have shown that no matter the group, tourists or residents, the awareness of water salinity is low. This can be attributed to the lack of education on this topic. Surprisingly, the residents of Texel who are affected by water salinisation do not seem to have much knowledge on the topic. During this research there are a few discussion points that can be highlighted. These points are the acquiescence bias of certain questions and 4 different methods of collecting the data. Also, limitations were present in this report, such as the higher presence of tourists instead of residents, the random designation of the locations, nonrestricted time for survey collecting, and the division of age categories. Information should be provided to ensure that people become more aware of the problem. This can take the shape of school-based education or island-

wide campaigns. This will lead to an increase in people's understanding and, as a result, an increase in awareness of water salinisation.

2C Beta: A study of the awareness and adaptiveness of the residents of Texel on the topic of sustainable water use.

Purpose of the report:

The following report focuses on answering the question 'Regarding shortages of freshwater availability in Texel, to what extent would residents of Texel be willing to implement measures to ensure freshwater availability?' This is of vital importance because of the geographical and environmental qualities of the island, which makes it highly vulnerable to problems pertaining to freshwater availability and salinification (Verzilting Is Strijd Om De Balans: "Er Kan Hier Maar Vanaf Één Kant Zoet Water Komen," n.d.-b). Thus this report was made to assess the current awareness of the residents of Texel on these topics and willingness for the implementation of sustainable solutions relating to these problems. These results could then be used to inform investors and stakeholders on which solutions would be perceived best by the local population.

Methods used:

To gather this data an extensive survey was used. This survey was divided in three parts, to measure awareness a series of questions pertaining to water availability and salinification were asked to assess the current awareness among residents of Texel on these problems. The second part was focused on assessing willingness in favour of three proposed measures which would all help with the water availability problems; these measures will be labelled as M1(roof), M2(pond) and M3(dunes) which will all be discussed in detail in the literature review. The third part would be used to assess our demographic to ensure the validity of the collected data and if it is representative of the population.

The quantitative data will be analysed through coding and will be assessed using excel; this will be discussed further in the methods section.

Findings and conclusions:

After thorough analysis the following conclusions and results were reached.

- Texel's residents are quite aware of the problem of salinification, with the majority stating that they know what salinification entails.
- Texels residents also have a relatively high willingness for the implementation of measures that ensure future freshwater availability. The results show less affinity for big scale projects and preference for more local small scale solutions like roof water collection.
- A high affinity for individual behaviour change can also be noted as more than half of the participants stated that they would change their personal water consumption.

Recommendations for improved freshwater availability through policy change:

Future policy changes and investment would be more effective and generally accepted by focusing on the funding and appeal to install these measures in a more individual level for example on residents property. And to focus less on bigger scale projects like increasing the dune area because of the less positive response on these solutions.

If a big scale measure were to be implemented it could be crucial to spread more awareness to ensure a positive acceptance response from the local populus on this subject.

2D: Salinity surface water

2D: Spatial Distribution Of Water Salinity On Texel

The island of Texel is one of the largest and most populated islands of the Netherlands. The population of Texel requires resources that are becoming scarce, like fresh water. As an artificially built island, Texel has extremely limited sources of fresh water, like rain and the groundwater aquifers already present. As the climate crisis keeps changing the environment around Texel, these groundwater sources are being infiltrated and overrun by saltwater, diminishing the limited freshwater resources even more. This research aims to understand and map the progression of water salinity over the whole island. We will attempt to answer this research question: What is the spatial distribution of the water salinity of surface water on Texel and what are the explaining factors? Using the data gathered on the fieldwork, we aim to answer this question and try to show the correlation between electric conductivity (EC) and varied factors such as elevation, pH, soil moisture, and water temperature.

2E: Water and biodiversity

2E Alpha: Salinity and Biodiversity on Texel

Global climate change affects oceans and the water cycle by inducing higher rates of evapotranspiration which lead to higher salinity levels in a process known as salinisation. These higher salinity levels impact plant growth through saltwater intrusion whereby saline water intrudes into freshwater aquifers, making the surrounding natural surface water and soil more saline. Salinization predominantly impacts low-lying areas and islands - such as Texel. This makes Texel an ideal site for biodiversity and salinity research as there are very few published studies considering the relationship between biodiversity and salinity, and the island supports a rich spread of plant biodiversity across its landscape.

The goal of this research is to provide an answer to the research gap identified, the relationship between salinity and plant biodiversity, while also considering potential external factors such as pH, distance from the water source, plant cover, and proportion of salt-tolerant species. These aspects are identified in the form of the research question: What is the relationship between the salinity of water and soil around different types of inland water-bodies and the plant biodiversity on Texel? Furthermore with the sub-questions: To what extent is the measurement gradient a determining factor for plant biodiversity and soil salinity on Texel? What cover of plant species was found: is this homogeneous or heterogeneous? What proportion of total plant biodiversity consists of salt-tolerant species? To what extent is pH a determining factor for plant biodiversity on Texel?

The methodology used to investigate this research gap consists of a fieldwork approach which measures water and soil salinity as well as pH and biodiversity at 3 water-body locations each with 12 sampling points taken on a gradient in each cardinal direction (North, East, South, West) at 0m, 5m, and 25m. These water-bodies are chosen based on a classification ledger and are selectively distributed across the island from East to West to provide an evenly spread set of results.

The findings of this research confirm the negative impact of salinity on plant biodiversity. The results align with previous research into salinity and plant life and provide further evidence supporting the need for conservation efforts to mitigate the effects of salinity on ecosystems. Despite the limitations and uncertainties associated with this study - such as changes in water-body locations during fieldwork, inter-researcher variability, reliance on technology and inconsistency with measurement devices - it highlights the importance of considering salinity levels in water and soil management

strategies. The results also indicate the effect of distance from water-bodies on salinity and biodiversity as well as the lack of effect of pH on these same variables.

By addressing the challenges and expanding the understanding of the complex interactions between salinity and plant biodiversity, the protection and preservation of ecosystems for future generations can be improved. Furthermore, with more time and expertise at hand, a more comprehensive study could be performed to gather a stronger database - as this study has proven the need for more research and discussion regarding the topic of salinity and its connection to plant biodiversity.

2E Beta: Assessing the Impact of Salinity Levels on Biodiversity: A Case Study of Texel Island

Texel's exceptional location and unique characteristics not only attract tourists but also present distinctive challenges, particularly the escalating issue of soil salinity on the eastern sides of the island. This problem extends beyond Texel, affecting regions worldwide and becoming an increasingly widespread concern. Given that soils play a vital role in achieving the Sustainable Development Goals (SDGs), which encompass various objectives related to salinity, it is crucial to investigate the implications of this process. The impact is expected to manifest not only on the Texel ecosystem but also on drinking water and irrigation systems. The extent to which these impacts pose a threat to life and ecosystem functioning on Texel remains to be explored.

A key aspect of assessing ecosystem functioning is examining the functional biodiversity of ecosystems in relation to soil salinity levels. This study focuses on the interaction between salinity and plant functional biodiversity, aiming to comprehend the degree to which rising soil salinity levels coincide with less diverse ecosystems in terms of functionality. Functional biodiversity is composed of three dimensions, all covered in this study; functional richness, functional evenness and functional divergence. Subsequently, the objective of this study was to determine how soil salinity affects the three indexes of functional biodiversity of plants surrounding inland water bodies on Texel. To investigate this question, three water bodies were selected for sampling in the four cardinal directions, measuring electrical conductivity, pH, and plant species abundance in a 1 m x 1 m grid at 0m, 5m, and 25m intervals. The selected water bodies are De Nederlanden and Nieuw Buitenheim, located on the west and east sides of the island, respectively, while Westerkolk is situated in the central region. From the species abundance, functional richness and evenness of the vegetation grids were calculated; the number of functional groups present in the vegetation grid accounted for functional richness, while the Shannon evenness index was used to quantify functional evenness. For functional divergence, a formula calculating the logarithmic functional divergence was utilized.

The results of our study reveal a correlation between functional richness and salinity with R^2 at 0.235. This correlation is in line with the literature reviewed. Further, the results show a correlation, contrary to previous literature; between functional evenness and salinity at R^2 at 0.429. However, the results show no correlation between functional divergence and salinity. Due to these conflicting results, the hypothesis of a correlation between salinity and functional diversity cannot be fully accepted. Further research should utilize a larger sample size to clarify the link between the selected variables. After conducting this research, the following policy recommendations came to light. Firstly, as there seems to be a correlation between salinity and functional biodiversity to some extent, it is crucial to organize more monitoring to provide more data and indicators for changes taking place. Secondly, substantial investment should be directed to limit the potential anthropogenic heightening of saline soils. Lastly, seeking support from national or international organizations facing similar salinity challenges or those specializing in water management and investing in further research on how salinity affects ecosystem functioning on Texel is recommended. By sharing information, knowledge, and skills, collaborative efforts can be undertaken to effectively tackle the challenges associated with salinity.

2F: Geese induced eutrophication in dune lakes

2F: Geese induced Eutrophication of Dune lakes on Texel

The Dutch Island of Texel is home to nature reserves and conservation areas surrounding the dune lakes. This study research eutrophication, which is the degradation of water quality due to nutrient overload. The dune lakes contain many bird species, whose faeces contain nutrients that could contribute to eutrophication. The research will examine geese populations in respect to factors that contribute to eutrophication. The goal is to investigate the relationship between the geese population present at dune lakes, and eutrophication of water. This brings us to the research question: To what extent do geese impact eutrophication in dune lakes in Texel.

Eutrophication will be measured through the chemical compounds present in the water, namely nitrite, nitrate, and phosphate. With collaboration with park rangers on Texel, three dune lakes that home geese were sampled. This data was processed in SPSS, it was modelled, tested for normality, and differences among samples. Through data analysis it was found that there was not enough data to come to a conclusive answer to the research question. Due to challenge with sampling, and short timespan allocated for the study, the data collected does not show strong enough evidence of a significant relationship between geese population and eutrophication, although evidence of eutrophication in each lake was found.

For future studies, it would be helpful to conduct a study like this over a span of many months. This study focused on the geese populations in a specific moment of time and was only measured for one day. To come to a conclusive result, carrying out a study that uses a multidisciplinary approach over a long period of time, for example nesting season, would have a better chance of answering the research question presented above. By multidisciplinary, it means to employ experts from different scientific fields of study, for example wetland scientists or bird specialists. Each lake showed signs of eutrophication, therefore continued monitoring of them to ensure water quality maintains at a healthy level is recommended. This study is not able to fully provide policy recommendation, although it sheds light on the need for future research on Texel concerning eutrophication.

3. Imagining futures for Texel and mobility

3A: The future as imagines by young Texelers

3A: The Future of Texel Imagined by Young Texelers

Our research aimed to gain a deeper understanding of the factors that influence young Texelers' decision to stay, leave, or return to Texel later in life. By gaining an understanding of the motivations and needs of the younger generation, we provided a clearer picture of Texel's future. The research employed semi-structured interviews with a diverse group of young individuals aged 16 to 30, allowing for a comprehensive exploration of the factors influencing their life on the island.

The 'unique lifestyle' of Texel is the main driver for young Texelers to stay on the island; however their final decision is dependent on whether the island meets their needs. As non-Texelers, we have an outsider perspective on both what constitutes this unique lifestyle' and what the young Texelers needs are. Undoubtedly, these definitions vary largely among individuals, so in-depth interviews were conducted to collect data, ensuring a deep understanding of the individual participants' perspectives on their future.

The findings revealed that Texelers were concerned about housing, education, accessibility, nature and work, as proposed prior to the interviews. Furthermore, individuals shared other insights which were influencing their decision. The most frequent themes included: the municipality, healthcare, high-educated jobs, entertainment, personal relations, tourism and self development. Although, there was often a strong interest in pursuing a life on the island, participants found that their needs were not fully met, leading them to consider leaving the island in the future.

We found that Texelers wanted to create an environment that can meet their needs in the future, regardless of how interested they are in pursuing a life on the island. For example, participants expressed a common desire to transition Texel's focus in tourism to a more local-based approach. This shift could partly address some of the challenges identified and enhance the quality of life for the island's current residents.

3B: The future as imagined by Texel's hospitality sector

3B: The Future as Imaged by Texel's Hospitality Sector

The hospitality sector is one of the most noteworthy industries on Texel. Thus, for this sector to become more sustainable and contribute to a better environment for the future is substantial. This paper will focus on three significant levels of the hospitality sector: Hotels, Restaurants, and Campings. The aim of this research is to observe how hotels, restaurants and campings of Texel expect to thrive while contributing to a sustainable future.

During the data collection process, eleven interviews were held on Texel with owners, managers, employees, and others with experience in hotels, campings and restaurants. This was to give answers and insights into the following concepts: Plastic, Energy, Innovations, Food, Water, Business and Customers. From the literature review conducted, it was 3 determined that these concepts are the most meaningful to target for a sustainable future in the hospitality sector of Texel.

Throughout the research process, it was discovered that most companies in this industry are driven by whether there is an economic benefit for the business rather than sustainability. It was concluded that this economic perspective is often more important than an ecological perspective. Business practice managers often generate innovative ideas to address waste and consumption issues, however, they may not actively implement these ideas unless they are legally obligated to do so. Which meant for a successful policy to be implemented in a system such as Texel, there should be a focus on thriving profitability while becoming sustainable.

Furthermore, it should be noted that the hospitality sector frequently faces challenges in effectively educating guests about the responsible use of their services, such as water consumption in showers and bathrooms or proper recycling. Often customers in “vacation mode” are inclined to consume and waste more resources with a desire to break free from normal everyday societal expectations. This highlights a limitation in businesses' ability to influence customer behaviour and underscores the importance of striking a balance between sustainability and customer satisfaction.

3C: The future as imagined by Texel residents

3C: The future as imagined by Texel residents

Sustainable development and the well-being of the local residents are two intertwined topics which cannot be tackled separately. To question which priorities Texel residents have for their future well-being is therefore an important step to achieve sustainable development which is accepted and supported by the local residents. The project on the importance of different categories for the future well-being of Texel residents was conducted by Anniko Bleijenberg, Dominic Lux, Samuel Martin, Venus Larsen and Wei Yang, all students of the Global Sustainability Science bachelor at the Utrecht University. The students conducted research as part of a fieldwork project in March and June 2023 on Texel.

Guided by the overarching topic “The future as imagined by Texel residents”, the research team conducted a survey questioning the importance of five developed categories for the future well-being of Texel residents. The five developed categories are: Functioning Ecosystems, Functioning Economy, Accommodation, Mobility and Sustainable Practices. These categories display a framework for future contentment and sustainable development on the island of Texel. The survey furthermore asked the participants to provide personal data in the form of age, job and income. This is to align the ranked categories for future well-being to certain age-, job- and income-groups.

Following this, the guiding research question for this research is: Which of the developed categories do Texel residents prioritise for their future well-being? To identify the mentioned similarities in e.g. age-groups, the sub-question: How do the found priorities align with the reported personal data?, helps to make statements regarding the different sub-groups.

As the survey is aimed at Texel residents, the research team focussed on residential participants. The survey received a total of 50 responses. 90% of the respondents were Texel residents and 97,9% full-year residents. In regards to age, the survey was answered by people ranging from 14 to 67. The majority of the respondents were between the ages of 14-23 and a total of 68% were under the age of 34.The insights into the different priorities for future well-being of Texel residents will be described in the following, starting with the open questions and followed by the rating questions.

Most Texel residents interact with the natural environment by going to the beach or forest and by doing physical activity outdoors. Young Tesselaars and low-income residents stated that job opportunities are of high importance for their well-being. The majority of residents do not feel influenced by the current shortage of affordable housing. Travelling and commuting by bike is most common for Texel residents, however, residents with a higher income than 4000€ per month prefer the car. Ultimately, most of the residents do not practise any sustainable actions.

Biodiversity and nature conservation are of high importance for texel residents, as well as a stable tourism sector and job availability on the island. The availability of housing is of very high importance, though, tourist accommodations are of low importance for the residents well-being. Sufficient public transport possabilities and a developed road system are of high importance, just as

waste management options. Lastly, the availability of green energy and sustainable practices is of low importance.

The residents' suggestions for additional categories for future well-being are firstly agriculture and fisheries and secondly youth activities, which are primarily demanded by young Texel residents.

As a general conclusion, the availability of housing and accommodation is most important for texel residents and their future well-being. This is followed by a functioning economy and functioning ecosystems.

The conducted research is however linked to some limitations. The residential participants were mostly involved in the hospitality and gastronomy sector. This might lead to a biassed outcome of the survey. In addition, the sample size of 50 participants is not accountable for all inhabitants of Texel and therefore not fully representative. Furthermore, follow-up questions with dutch participants while conducting the survey in dutch were hard to answer, as the majority of the research team and the students are english speaking.

Besides the described limitations, the survey highlights the importance of available housing, a stable tourism sector and the availability of jobs for the future well-being of texel residents. Additionally, the preservation of the natural ecosystems is of high value for future well-being.

3D: The future for housing and work

3D Alpha: Housing Challenges in Texel Experienced by Local Residents, and Potential Solutions for the Housing Challenges Based on Local Experiences'

This research aimed to discover and form potential, feasible solutions towards housing challenges in Texel based on local resident perceptions about these challenges, by answering the two research questions: 'What are the local views on the housing situation in Texel?' and 'Based on the Local Perceptions and Experiences, What Are Potential Solutions for the Housing Challenges in Texel?' This research aimed to represent the local opinions in the solution-forming process, hence enabling future interactive governance which results in higher efficiency of governance towards resolving housing challenges and other sustainability issues.

In this research's methods, interviewees were randomly selected in order to collect data on local perceptions and opinions on their perception of the housing situation in Texel. Inductive coding and reasoning were used in order to develop the final 6 potential feasible solutions in order to resolve housing challenges in Texel. Furthermore, all interviews were designed as semi-structured interviews and all codes were created using inductive coding. This research was able to draw 6 potential feasible solutions for resolving housing challenges in Texel based on the local residents' opinions and perceptions:

1. Stop allowing second-home purchases.
2. Split existing housing into smaller units if possible.
3. Build more housings
4. Make sure that in new housing young people and people that work in essential and relatively low-wage sectors have priority rights for the purchase or rental.
5. Reintroduce legislation that gives you a 'loan' when first purchasing a home, which gets deducted when selling it later on.
6. Build social housing instead of complicated and expensive projects. Prioritize simpler and cheaper buildings.

The implication of this research is that when forming a solution or policies regarding resolving housing challenges on Texel, the 6 potential feasible solutions this research concluded should be used. Furthermore, local opinions and values must be considered as government-formed policies and practices are often not satisfying the local residents who are affected by the formed policies.

In the research process, some gaps in information appeared. Notably, there were numerous ideas about legislation that could help alleviate housing challenges in Texel. However, there are very few studies that study the effectiveness of housing legislation, especially in island settings. Therefore, we recommend future research be done on the effectiveness of housing legislation after implementation in island settings. Furthermore, cross-cultural and cross-geographical data collection are recommended in order to obtain diverse local resident perceptions in order to formulate a potential generalizable theory/framework.

3D Beta: The fleeing of the youth? The future for housing and work in Texel

Texel is an unique island that heavily relies on tourism for its economic growth. However, this reliance on tourism has led to an economic monoculture, raising concerns about the future of Texels economy. Our research addresses these issues by investigating the relationship between tourism, housing availability/affordability and participatory modes of governance.

Through interviews with stakeholders, it is found that most stakeholders agree that the large number of tourists does not affect the price of housing on Texel. Even though this is contradictory to what previously existing literature showed. The stakeholders instead named Texels characteristics, such as its limited size and nature preservation to play a more significant role in the housing problems. Therefore, it is suggested for future research to focus on understanding Texels specific characteristics instead of focusing on the link to tourism.

To fix the housing market stakeholders name the need for more houses. They explain that the housing markets problems are caused by a very limited number of houses instead of the price of the existing ones. Moreover, the municipality regulates the purchase of housing for nonresidents, making situation even more complicated. To solve this problem stakeholders recommend building more houses and making these accessible for employees and families. By solving the housing problem the work problem will also be addressed as the islands focus on tourism has led to a lack of higher-educated job opportunities. Young residents commonly leave the island in search for higher education which is not available on Texel and rarely return due to the limited job opportunities. Stakeholders think that the creation of higher educated jobs supported by new houses can diversify the job market and be able to attract a more skilled workforce leading to economic growth and reducing Texels reliance on tourism.

Participatory governance is a vital tool in the future development on Texel. Stakeholders unanimously agree that the involvement of citizens in the decision-making process is crucial for achieving the goal of a more sustainable Texel. This finding shows the importance of collaboration in shaping the islands future. Our recommendations include implementing frameworks allowing engagement with multiple stakeholders to allow collective decision-making processes.

In conclusion, this paper shows the challenges Texel is facing in terms of tourism, housing, job opportunities, and participatory governance. Our findings show the need for certain actions needing to be taken to ensure a more sustainable Texel. Our policy recommendations include: increasing housing availability, diversifying the job market by promoting higher educated jobs, and the creation

on participatory modes of governance involving all stakeholders. By implementing these recommendations, Texel is set up for a more sustainable future.

3E: The future for automobility

3E: The Future of Automobility on Texel

This report provides an overview of the impact automobility has on the island of Texel and its community, and will aim to provide suggestions to improve Texel's current situation. The report is 3 based on both fieldwork and literary research and has succeeded in answering all upcoming sub questions and the main research question. Automobility has several impacts, or costs, which come in different forms. The costs that will be tackled in this report are social, economic and environmental costs. The social costs for example relate to traffic accidents and air quality, economic costs relate to annual average costs of owning a car and environmental costs relate to biodiversity and wildlife disruption. Still, the benefits of automobility such as supplying retail and hospitality and travel speed are deemed indispensable.

To address the benefits and costs related to automobility, the recommended approach is to reshape automobility entirely to make it more sustainable. This includes ensuring that sustainable automobility is also affordable, and that it is strongly encouraged amongst Texel's inhabitants. Therefore, it is also a policy recommendation to the municipality of Texel, as they can and should lead the way in encouraging sustainable transportation such as electric automobiles. With an estimated 91,4% of the automobiles on Texel relying on fossil fuels, there is a clear lack of willingness to reshape in the direction of sustainable transportation. The municipality of Texel and its policymakers could for example address this by implementing laws regarding subsidizing electric vehicles, creating environmental zones, and most importantly increasing the numbers of charging stations, as their scarcity drives away potential customers for electric automobiles.

The report and the given recommendations could possibly lead to a more sustainable future due to the reshaping of automobility, while maintaining the essential benefits of automobility. All in all, it should lead to an affordable, greener and safer situation and for all automobility on Texel.

3F: The future for sustainable mobility

3F: How can the sustainable mobility system of Texel benefit the economic prosperity of Texel and how can this be improved?

In a time of increasing tourism and transportation being as important as ever, Texel's sustainable mobility plays an important role on the island. This report critically examines the current sustainable mobility system on Texel (mostly consisting of public transport) and investigates its ties with economic prosperity. The research question that is answered reads as follows: 'How can the sustainable mobility system of Texel benefit the economic prosperity of Texel?'. To answer this research question, fieldwork on Texel has been done to check the bus stops on accessibility via metrics such as seating and rain cover. Additionally, the connection between the mainland and Texel via ferry has been researched. Finally, the quality of the Texelhopper and bus line 28 was analysed.

Results of the report show that most of the bus stops – particularly those utilized by the shuttle bus service of the Texelhopper – do not have adequate accessibility for its users. Many of the stops consist only of a pole and do not have any further facilities such as bike parking or seating. Furthermore, the research regarding the ferry showed that the ferry is being used by passengers all day long, though there are significant differences in who is using it depending on the time of day. Bus line 28 was shown to be utilized by both residents and tourists but was mostly empty and had a lot of delays. The Texelhopper shuttle bus system is easy to use yet not punctual as other users greatly influence the departure and arrival time.

Overall, the sustainable mobility system does its job, but not in a stunning matter. Utilizing the Texelhopper is slow, and public transport is only really viable for people who are not in a rush. This causes Texel's residents and tourists to choose using private cars over public transport. This negatively affects the sustainability of Texel and causes (especially young) Texelers to move to the mainland, for studies and possibly jobs.

However, changes can be made to improve the sustainable mobility system to benefit the economic prosperity of Texel. These changes include providing bus stops with proper seating and rain cover and shade, making sure the busses are electrical, and giving people using Texelhopper an estimated time of arrival.

4. Renewable energy

4A. Perceptions on wind power projects

4A: Perceptions on wind turbine development on Texel

Our scientific research report aims to understand the perceptions and drivers for resistance or acceptance towards wind turbine development on the island of Texel from an energy justice perspective. The report explores the current literature on stakeholder perceptions of wind turbines, identifies a research gap in understanding the influence of wind power planning and development on stakeholders' perceptions, and proposes the use of energy justice as a theoretical framework.

The approach for the report involves interviewing a variety of stakeholders, including Texel's locals, farmers, tourists, business owners, and representatives from political parties and corporations. The interviews were semi-structured, allowing for in-depth conversations and exploration of the various perceptions. The data gathered from these interviews was transcribed, coded, and analysed using the energy justice framework, focusing on distributive justice, procedural justice, and recognition justice.

According to the study's findings, the majority of the interviewees were in favor of further development of wind energy on Texel. They highlighted factors such as the demand for more affordable and renewable energy, the island's constant wind patterns, and the conviction that the aesthetic impact of wind turbines may be accepted or even appreciated over time. The noise pollution of wind turbines, according to some interviewees, can be equated to other common noises like traffic.

On the other hand, there were interviewees who expressed concerns about the negative visual impact of wind turbines on the landscape of Texel and potential harm to the flora and fauna. They suggested exploring alternative forms of renewable energy, such as solar or wave energy, which they perceived as less harmful to the environment and landscape.

The findings from the research provide insights into the perspectives of different stakeholders on wind turbine development on Texel. The report emphasizes the importance of considering energy justice in the decisionmaking processes related to wind energy, particularly in terms of equitable distribution of benefits and burdens, fair decision-making processes, and recognition of social and cultural differences.

The report concludes by answering the research question and discussing the implications of the findings in relation to energy justice. It highlights the need for further research and understanding of the impact of wind turbines planning and development on stakeholders' perceptions to ensure a just and sustainable energy transition.

Overall, this research report contributes to the existing knowledge by examining stakeholder perceptions of wind turbines on Texel and providing insights into the application of the energy justice framework in analyzing these perceptions. The findings can inform decision-makers, project developers, and regulators in their efforts to foster acceptance and address concerns related to wind power deployment in Texel and similar contexts.

4B: Potential wind power projects and impact on population

4B Alpha: Potential Wind Power Projects and Impact on Population on Texel

The implementation of wind power plants is a necessary step to introduce energy security and reduce greenhouse gas emissions. On Texel, it is predicted that wind turbine installation will enable the transition towards a renewable energy system (RES). The research question derives directly from

the aforementioned subject: How are different potential deployment sites for wind turbines perceived by the Texel population?

To design different geographical locations for the construction of a wind power plant, the Quantum Geographic Information System (QGIS) software is used, due to the possibility of filtering out unavailable areas for deployment. Successively, the annual energy production of each location is calculated. Throughout the fieldwork on Texel, a number of interviews are conducted to explore peoples' perceptions on wind farm installation in the proposed areas. Finally, a Multi-Criteria Analysis (MCA) provides a framework that enablesthe group to evaluate the findings and define the most feasible, based energy potential and people perceptions, wind farm deployment site on Texel.

Based on QGIS analysis and technical potential calculations, five locations are chosen from a wider range of available areas to be the subjects of research. In particular, two areas are situated in the northern part of Texel, two in the southern, and one offshore. These locations were proposed to 11 participants of the interviews: 5 residents, 2 tourists and 4 experts. The respondents ranked the locations from most to least desirable and explained their choice by presenting us with the several aspects influencing their choice, namely, energy potential, community reaction, and environmental issues. The MCA assessment allows to discover that the offshore location is the most desirable from every criterion of the research, followed by the northern part of Texel, and lastly the southern.

The results indicate that the implementation of a wind power plant is a sensitive topic due to the required political, and economical change, and due to the necessary societal change in people' perceptions. The likelihood of resistance to deployment of wind farms on Texel is high. Currently, there is not the required sense of urgency to take action, to bring about the necessary alteration of Texel community's opinion. However, the interviewed locals have shown openness to the idea of implementing a wind farm offshore. Additionally, in Texel, it is fundamental to take into consideration the natural ecosystems, and species which would be affected by the installation of wind turbines.

The sample size of the interview is not big enough to abstract anything definitive; therefore, it is recommended to conduct a more detailed analysis on what is the general perspective of Texel's population on wind energy, and on a hypothetical installation of wind turbines onshore and offshore. Furthermore, it is suggested to create an energy system on Texel, which allows the North to have enough grid-capacity as the South in order to solve the issue mentioned in the interviews. The latter can be done by the government together with the energy companies by improving smart grid technologies, and therefore, by allowing an easier energy transmission process is efficient, wherever the plant where the energy is produced, is located.

4B Beta: Unveiling Preferred Windmill Sites on Texel: a Study of the Population Perspectives

This executive summary provides an overview of our research findings and their implications, focusing on the identification of potential locations for windmill construction in Texel. Our research question aims to determine suitable locations that effectively meet the island's energy demand, minimize environmental impact, and consider population preferences. By utilizing GIS, we created maps to analyze the geographical/technical potential and feasible locations for wind power on the island. Our research contributes new insights as previous investigations mainly focused on a few locations mentioned in the Regional Energy Strategy plan for North Holland. However, we identified additional viable locations, including the northern-east part of the island and the area between Den Hoorn and Den Burg.

To gather insights on onshore and offshore windmill installations, we conducted interviews with local residents. Although our sample may not represent the entire population, we aimed to gain

comprehensive insights into the perspectives and preferences regarding wind energy production in Texel. Our findings revealed divergent opinions on offshore windmills, with concerns raised about the distribution of profits and potential impacts on marine ecosystems and fisheries. On the other hand, onshore windmills face challenges such as lower power generation and negative effects on nature and the population.

Texel's unique natural environment and its significance for tourism emerged as prominent themes in the interviews. Residents emphasized the importance of preserving the island's nature, as it attracts a large number of tourists each year. They emphasized that windmill projects should consider the island's rich biodiversity and the conservation of natural areas and traditions. However, it is crucial to acknowledge the uncertainties and limitations encountered during our research. We observed discrepancies in residents' opinions, potentially influenced by the higher willingness of individuals who supported windmills to participate in the interviews. Our qualitative sampling approach aimed to gather relevant insights rather than achieving equal representation. Nonetheless, the one-sided nature of the sample poses a source of uncertainty in our results. Additionally, the use of semi-structured interviews with a smaller sample size limited the generalizability of our findings to the entire local population. Instead, our focus was on understanding the factors influencing individuals' opinions on windmills in Texel.

To summarize, our research highlights some potential locations for windmill construction in Texel with their own advantages and disadvantages. Offshore windmills offer landscape preservation but raise concerns about marine ecosystems, dependence on the mainland and direct benefits to the island. Onshore windmills in the northern and southern parts face challenges related to wildlife impact, grid limitations, visual disruption, and tourist opinions. The area between Den Hoorn and Den Burg minimizes disturbances to residents and bird populations but faces hurdles due to its proximity to residential areas. The report recommends further research and stakeholder engagement to ensure inclusive decision-making processes. Policy recommendations include:

1. Conduct comprehensive studies to assess the environmental impact of windmill installations on marine animals and bird species.

2. Evaluate the feasibility of increasing the island's energy independence by exploring alternative energy sources.

3. Prioritize community engagement and address concerns of the local population by actively involving them in decision-making processes.

4. Develop a clear policy framework that balances the island's energy needs with environmental preservation and tourism considerations.

5. Invest in infrastructure development, such as improved cable connections and grid capacity, to support efficient energy transmission.

These recommendations aim to guide policymakers, stakeholders, and the local community in making informed decisions that contribute to Texel's energy goals while minimizing environmental impact and respecting population preferences.

4C: Texel scenicness

4C Alpha: Texel Scenicness

This research aims to find the best place for wind turbine placement on Texel based on the scenic perspective of different parts of the island as rated by both tourists and residents. The involved

methods include several aspects, such as taking pictures, setting up a GIS map of these pictures, and surveying the tourists and residents on Texel.

At 24 sampling points, all located on the northern part of the island, four pictures (in the northern, eastern, southern, and western directions) were taken of the surroundings per point, which were afterwards implemented into surveys to question the residents and visitors of Texel about the perceived scenicness. Per survey, ten pictures were rated on a scale of 1 to 10. Secondly, the survey collected personal data about our participants, which could be relevant when analysing the results.

The results of our fieldwork showed us that location 28, picturing dunes and a beach, received the best average scenicness score based on all four sides (the northern, eastern, southern, and western views combined). On the other hand, location 31, picturing mainly roads, a roadside, and a channel, received the lowest rating based on the scenicness questioned in our survey. With regard to single directional photos and their perceived scenicness, the northaligned photo of location 50, picturing the lighthouse, had, on average, the highest scenic rating per single picture, whilst the west-aligned picture of location 48, displaying farmland, received the lowest. All these findings suggest that areas with low human interference score high on scenicness and vice versa.

While comparing different respondent groups, it was found that, in general, the islanders of Texel gave similar ratings regarding the scenicness compared to Dutch residents that did not come from the island. However, there was a relevant difference between the average rating of residents of Texel and foreign tourists: visitors to Texel living outside of the Netherlands valued the landscape significantly less. When considering the age groups involved in the survey, it was observed that there were no relevant differences between the groups regarding the ratings they gave; age does not affect perceived scenicness.

To conclude, our research analyses the perceived scenicness of 24 different spots on the northern part of the island while identifying the most viable location for wind turbine deployment as seen by the stakeholders involved. These locations are numbers 31 and 32 together, creating a possible area for wind turbine placement. These observations and perceptions offered by the respondents can give way to decision-making processes that lead to the deployment of wind turbines on Texel.

4C Beta: Scenicness assessment of onshore wind sites using geotagged photographs and impacts on public acceptance

The need for renewable energy is on the rise as fossil fuels have been and will continue to be disastrous for our planet. As wind power is one of the main sources of renewable energy, the placement of wind turbines is of the utmost importance. However, there is significant resistance to wind power deployment on Texel due to its unique scenery and nature. To overcome this obstacle, we went in search for locations that were considered less precious to people on Texel in terms of scenicness so these locations could be used for future wind power deployment without fierce resistance.

Our research focused on the question ‘Which locations on Texel are best suited for wind power deployment based on their scenicness as judged by people on Texel?’.

To answer this question, pictures were taken across the island of Texel, and these pictures were then incorporated into a survey. In the following two days, this survey was conducted across the island. Participants were shown ten randomly chosen photographs of the island and were asked to rate each photograph on a scale of 1.0 to 10.0 with a specificity of 0.5. When analysing the data, the mean rating of each photograph was used to indicate the scenicness of each photographed location. This data resulted in various interesting insights.

Firstly, it became apparent that the citizens of Texel gave higher ratings to the photographs than tourists. In fact, we observed that the rating given by citizens was on average 0.96 points higher than the average rating given by tourists. Through an independent samples t-test, it was concluded that locals did, in fact, give significantly higher ratings than tourists. The political stance of the participants of the survey was also taken into account and was analysed. However, no significant difference between conservative or progressive could be found. Solely the group that identified themselves as being neither conservative or progressive tended to be less in favour of wind turbines. The gender of the participants was also asked and analysed, but no significant differences could be found, except that women were slightly less in favour of the actual installation of wind turbines in the locations they deemed to be the least scenic. No significant differences in the ratings themselves between genders could be found.

Ultimately the least scenic locations according to the people on Texel were locations 30, 29, 27, 13 and 49 meaning these locations are best suited to wind power deployment on Texel in terms of garnering least resistance due to visual pollution. A common characteristic of these lowest rated pictures was the presence of grasslands meaning grasslands are indicative of suitable locations for wind power deployment in terms of scenicness. Our policy recommendations are to place wind turbines on grasslands and listen to the opinions of the people on Texel as most respondents had a very strong opinion on the placement of wind turbines.

4D: Tourists and renewables

4D: Tourists and renewables: An analysis into the tourist's viewpoints on Texel regarding the island's renewable energy development

This research paper focuses on analysing the viewpoints tourists have on renewable energy initiatives on the island of Texel. It tries to thoroughly answer the question: What can be learned from tourist's viewpoints on Texel regarding the island's renewable energy development? By collecting tourists' different viewpoints on renewables, it analyses what this data means for the future of the island. This research is important, because 70% of all activities on Texel are related to tourism (Texel Travel and City Guide - Netherlands Tourism, n.d.). Therefore, if the island wishes to further engage in renewable energy development, an important aspect of that will be having an insight into how the tourists view certain renewables.

Based on previous literature it can be concluded that there are several gaps and not enough information about the viewpoints of tourists and whether or not they affect further renewable energy initiatives. This team therefore decided to conduct this research based on the current limited knowledge about the renewables on the island of Texel. It was concluded that the best research method for gathering and analysing data on the viewpoints would be a survey. A survey of a total of 15 questions was conducted in a span of 3 days on several different locations on the island of Texel. The group's aim was to target places on the island that would be most visited by tourists such as: De Cocksdorp, the lighthouse, De Koog and the beach. Based on the findings, it was concluded that overall opinions of tourists on solar energy in the solar park De Krim and tidal energy from the Symphony Wave power project were positive. Another important finding was seeing the opinions of tourists on wind turbines were quite negative with the majority of respondents stating that they would not prefer any wind turbines on the island at all. From the current findings it can be inferred that the tourists on Texel are much more keen on accepting solar and tidal energy initiatives rather than wind power. It can be assumed that the reason for this is because tourists would not enjoy seeing a large amount of wind turbines in the landscape of the island as well as not enjoying the sound the turbines would produce. Therefore it can be concluded that based on the tourist's

viewpoints it can be learned that the island of Texel should focus more on creating more solar and tidal renewable energy initiatives.

Policy recommendations for further initiatives:

1. Renewable energy initiatives on the island of Texel should be focused on solar and tidal energy.

2. The island of Texel needs to establish a new, clear and realistic target for meeting their energy goals by outlining the exact percentage of renewable energy that can be installed on and around the island.

3. Texel should support further research towards how newly placed renewables will affect tourists and their decision on visiting the island.

4. Better advertisement of renewables on the island can improve and change the tourist's motivations to visit the island. 5. Further research into how many wind turbines could be placed on the island and how this would affect tourism should be conducted.

4E: Power to the people

4E: Power to the people

The island of Texel has had the aim to be fully powered by self-produced renewable energy for years, but the inhabitant's general hesitation against wind farms and solar parks has slowed this process down considerably. One model that has been shown to advance the transition to clean energy in other locations is community-owned power utilities, which have helped to increase people's enthusiasm about renewables because of the increased community participation. As a result of this, we decided to conduct a research project with the aim of analysing the Texelaars' opinion about community-owned power. We also decided to analyse whether that opinion changes between people living in major built-up areas like Den Burg and people living in rural areas. The examination of these factors is relevant for the future development of Texel as there has been a lack of research on the opinion of Texel's inhabitants about energy transition and it seems unlikely to reach a fully sustainable power supply without the involvement of the local communities.

The research was conducted by distributing a survey to the inhabitants of Texel. The survey's questions were designed to analyse the Texelaar's opinion about different types of renewable power, which concessions they would be willing to make to reach a fully renewable power supply, and whether they would be willing to participate in community-owned power generation projects. It also included questions about the respondent's age, area code, and level of education to allow for analysis on whether these factors play a significant role in the opinion of Texel's inhabitants. Different methods of distribution were used, namely asking people in public spaces on Texel to fill the survey in, asking people working in shops or restaurants to complete the survey, printing out QR-codes to access the survey and placing them in mail boxes on the island. In total, 42 respondents filled out the survey.

Our results show that especially in more rural areas and among older respondents the inhabitants of Texel would be willing to join power cooperatives and invest in renewable energies. People with a higher level of education and people living in the major settlements of the island seem to be less interested in community-owned power. Next to that, our results did not show any major differences in the preferred source of energy between groups of different ages and across levels of education. The respondents place of residence on the other hand does seem to be a factor in the respondents

opinions, with people in larger settlements preferring solar power and people in rural areas wind power.

Overall, community-owned power utilities seem to have potential to further energy transition in Texel, especially since renewable energy prices are going to decrease in the future. That being said, these power cooperatives are likely going to be small-scale at first as mostly rural people seem interested. Next to that there will also be considerable resistance against building solar/ or windparks from many inhabitants worried about the aesthetic appeal of the island, the effects on tourism, and noise pollution.