Climate Adaptation in the Municipality of Dantumadiel; a Multi-Level Governance Analysis

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1. Abstract

This study investigates climate adaptation in the rural municipality of Dantumadiel, located in the north of the Netherlands in the province of Fryslân. Dantumadiel faces growing risks such as soil subsidence, groundwater depletion, heat island effects, and salinization. However, adaptation efforts are hindered by institutional, financial, and political barriers of 'ad hoc' governing. The research identifies actionable strategies for improving local adaptation, emphasizing the importance of spearpoint policies tailored to Dantumadiel's landscape, especially peatland degradation, supported through spatial planning and external funding. Intermunicipal cooperation is essential, especially on non-water issues like biodiversity and heat stress. Furthermore, enhancing local communication and community-based adaptation is vital, given the predominance of privately owned land. A participatory approach can strengthen public engagement and political legitimacy. Lastly, clearer distinctions between adaptation and mitigation must be made in both policy and practice. With strategic focus and collaborative implementation, Dantumadiel has the potential to emerge as a regional model for rural climate adaptation, bridging the gap between national frameworks and local action.

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3. Introduction

In the north of the Netherlands, in the province of Fryslân, lies a small to medium-sized (SMS) municipality called Dantumadiel (see figures 1 and 2). This municipality consists of eleven villages, no cities, and around 19.000 inhabitants spread out over roughly 87 square kilometers (Gemeente Dantumadiel, 2024). With a long history dating back to 1242, the municipality is no stranger to change (Monumenten.nl, 2024). However, adapting to climate change is a relatively new challenge. With possible national damages ranging from €77,5 to €173,6 billion by 2050, the political will for climate adaptation is growing (Ministerie van Algemene Zaken, 2024). However, investing in climate adaptation in the period of 2020 till 2100 could have a return of €4 (3.5–6.3) for every €1 invested. In Dantumadiel, the final responsibility for climate adaptation is a task for a municipal council (Dantumadiel, 2024). However, a significant proportion of the 574 publications on Google Scholar on the municipality is not dedicated to climate adaptation (Google Scholar, 2024). Most of the publications are dedicated to ‘confused people’ (Koekoek, 2017), birds (Postma & Jager, 2009), peat ground (Verboom & Thijs, 2010) and culture (Plat, 2014). It does not entail that this municipality does not have any resources for its usage for gaining knowledge and shaping policy. There are programs on the provincial, national, or European level for small to medium-sized municipalities. A few examples of these are the Life Local Adapt program from the European Union (2021), the Dorp van de Toekomst from the ‘Dorp van de Toekoms’, which translates to ‘Village of the Future’ (SDG Network Fryslân, 2023) or intergovernmental collaborations.

This paper is attempting to bridge the gap between the knowledge on climate adaptation for SMS municipalities and the municipality of Dantumadiel, as there is a need to know how to successfully adapt to upcoming climate change within the limitations of the municipality within

the multi-level governance space with a realistic and empirical perspective. This thesis is trying to answer the following research question:

'How can the municipality of Dantumadiel adopt the National Adaptation Plan (NAP) better locally to adapt to climate change, and what are the governmental barriers to implementation?'

This question will be answered through a description of climate change in the municipality, the soil composition, heat stress and the global discourse on climate adaptation, followed by laying out the historical and geographical background of the municipality of Dantumadiel including the political background, the National Adaptation Plan (NAP), the stakeholders involved and the possible barriers to adaptation. After the background, this paper explains its methodology and its components including participants, how the interviews were conducted, the ethical considerations and the researchers positionality as well as the data analysis and the expected results. Which is followed by the results, discussion and conclusion.

Figure 1: Geographical location of the province of Fryslân (Britannica, 2024)

Figure 2: Geographical location of the municipality of Dantumadiel in Fryslân in the red-lined area (Google search, 2024)

3.1. Climate Change in the Municipality

In the Netherlands, the climate is changing. Temperatures are rising, there are larger chances for extreme precipitation, heat stress, and longer, dryer periods. Due to the dry periods, the ground is sinking, and due to the sea level rise, there are higher chances for flooding (Ministerie van Algemene Zaken, 2024). These climate change consequences also negatively impact the health of the inhabitants, as a heatwave causes more deaths among vulnerable communities. A heatwave also negatively impacts the livability of an area, as well as the economy (Ministerie van Algemene Zaken, 2024). In the municipality of Dantumadiel, there is a large section of nature dry sensitive due to its dependence on groundwater, see Figure 3. To add to this, in a dry year, there is a large shortage of surface water in the entirety of the municipality (Klimaateffectatlas, 2024). This can lead to subsidence of the ground, see Figure 4, as well as

houses becoming crooked due to this (Klimaateffectatlas, 2024). Figure 5 displays the areas that are prone to this phenomenon. However, the Climate Atlas also displays low risks of flooding and urban heating (Klimaateffectatlas, 2024). However, with a rise of 3 meters, the areas known as “it Butenfjild” and “de Falom” are at high risk for salinization. To summarize the results from the graphs and literature, the municipality is the most vulnerable to ground subsidence, groundwater declines, water shortage, and salinization. This paper aims to take a look at what the municipality can do to adapt to these consequences, taking into consideration the already existing NAP, and what other stakeholders with similar risks are doing.

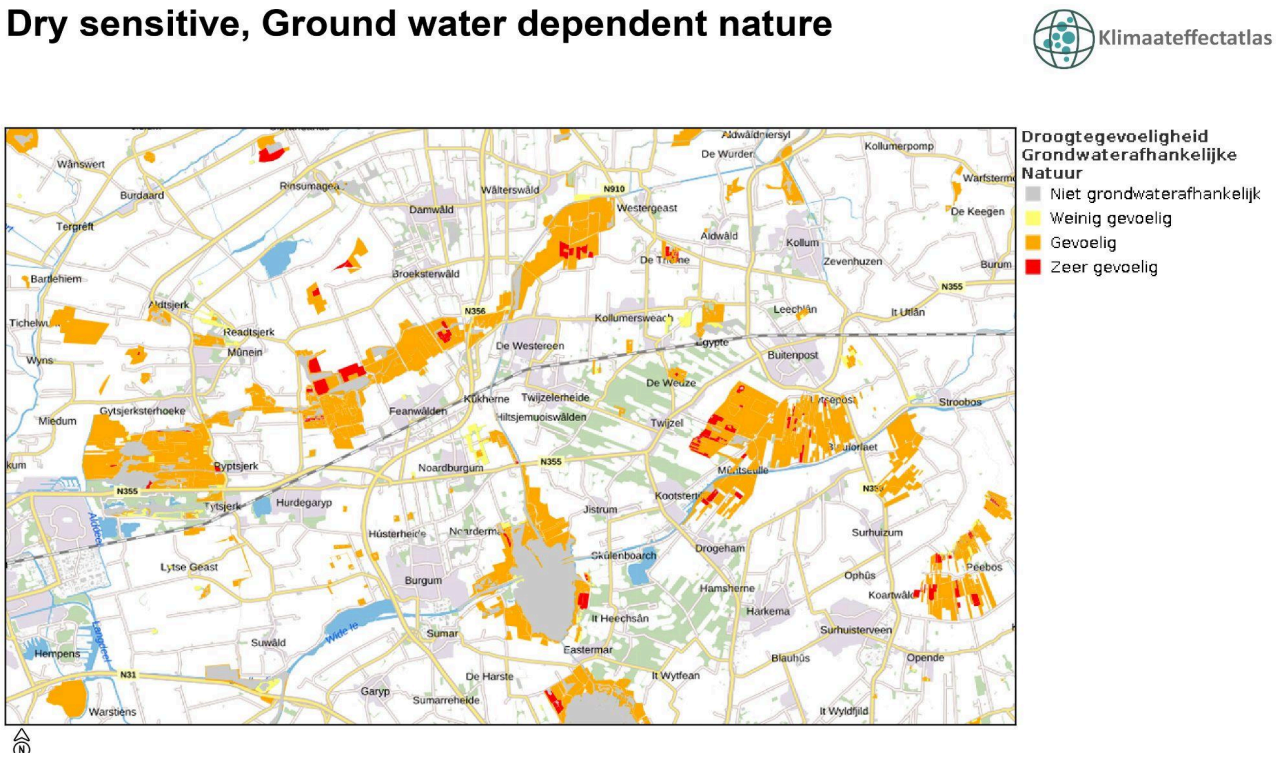

Figure 3: Dry-sensitive, groundwater-dependent nature (Klimaateffectatlas, 2024).

Subsidence in Dantumadiel

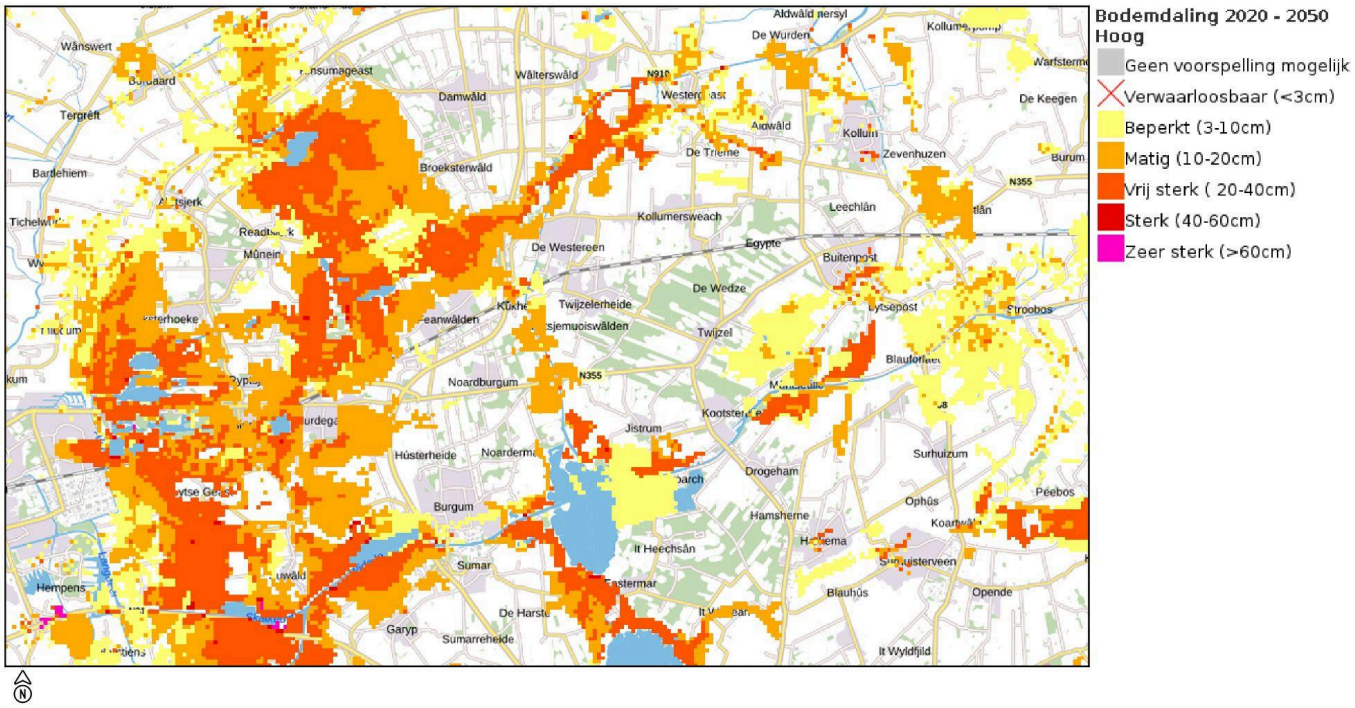

Figure 4: Subsidence in Dantumadiel (Klimaateffectatlas, 2024).

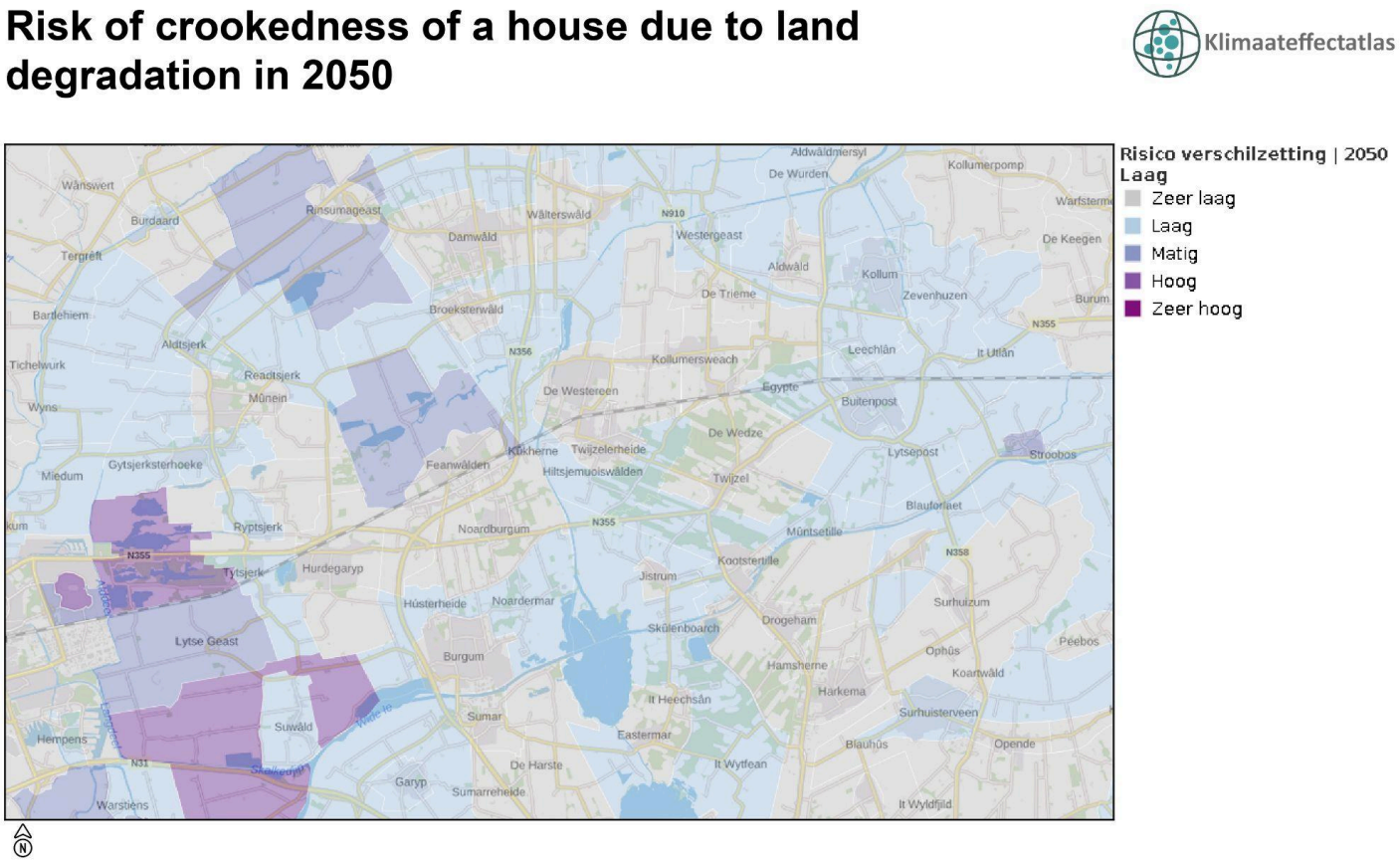

Figure 5: Figure displaying the risk of crookedness of a house due to land degradation in 2050 (Klimaateffectatlas, 2024).

3.1.1 Soil Composition

The municipality of Dantumadiel lies within a transitional zone in Fryslân where three primary soil types converge: sandy soils, marine clay, and peat. This variation results in a diverse and complex soil landscape that has significantly influenced land use and agricultural practices in the region. In the western and southern parts of Dantumadiel, sandy soils that originate from

glacial and aeolian processes are dominant. These well-drained, acidic soils are typically suited for pasture, forestry, and low-intensity agriculture (Alterra, 2011). Historically, they supported heathlands and small-scale mixed farming, reflecting their relatively modest fertility.

In contrast, the Eastern and North Eastern zones are composed primarily of heavy marine clay deposits. These soils are fertile and moisture-retentive, making them highly suitable for intensive arable farming. Their presence corresponds with the historical expansion of reclaimed land and polder agriculture in the Oostergo region (FrieslandWonderland, n.d.).

Dantumadiel also contains significant tracts of peat soil, particularly in lower-lying areas near Feanwâlden and the former moorlands. These soils formed under wetland conditions and are rich in organic matter, but prone to subsidence and very wet land conditions. Peatlands were historically exploited for turf cutting and have left a mark on both the physical landscape and cultural identity of the area (Brouns, Eikelboom, Jansen, et al, 2015).

3.1.2. Heat Stress

Distance to a cool place in the municipality is important for the escape of the warmth. In most of the villages in the municipality, cool areas are within reach of 200 meters. However, in the street of Haaijenhoeke in Broeksterwald, and among the Foarwei in Damwald, there is a significant distance for inhabitants to reach a cool spot, see figure 6 (Klimaateffectatlas, 2024). To add to this, the urban heat island effect is also present in the municipality of Dantumadiel as displayed in Figure 7 (Klimaateffectatlas, 2024). Urban heat islands are urban areas where the average temperature is higher than the surrounding natural areas. They are a result of the physical properties of buildings and other structures, and the emission of heat by human activities (Parker, 2010). The villages with the most heat island effect are the village of Damwoude, flowing into Broeksterwoude, Westreen, and to a lesser extent Feanwalden.

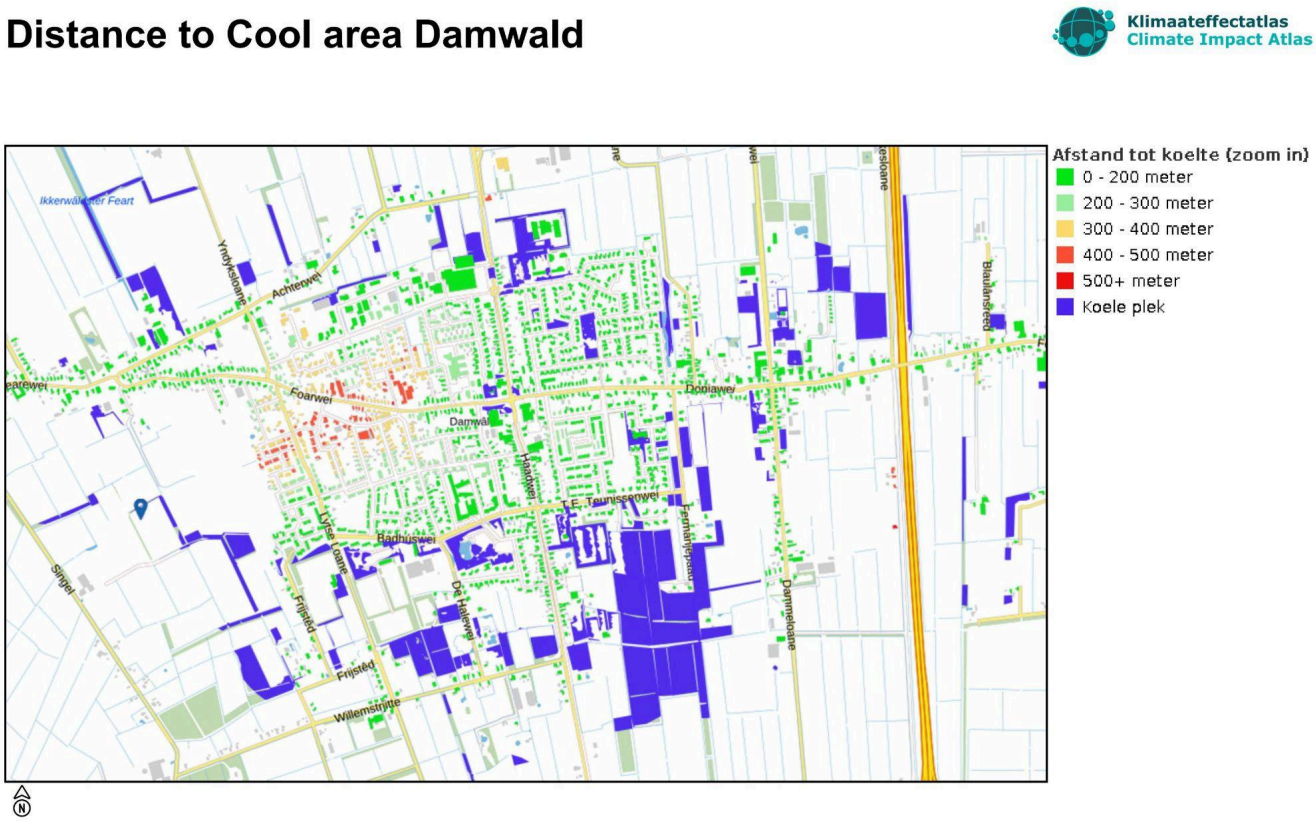

Figure 6: Figure displaying distance to a cool area in Dantumadiel (Klimaateffectatlas, 2024).

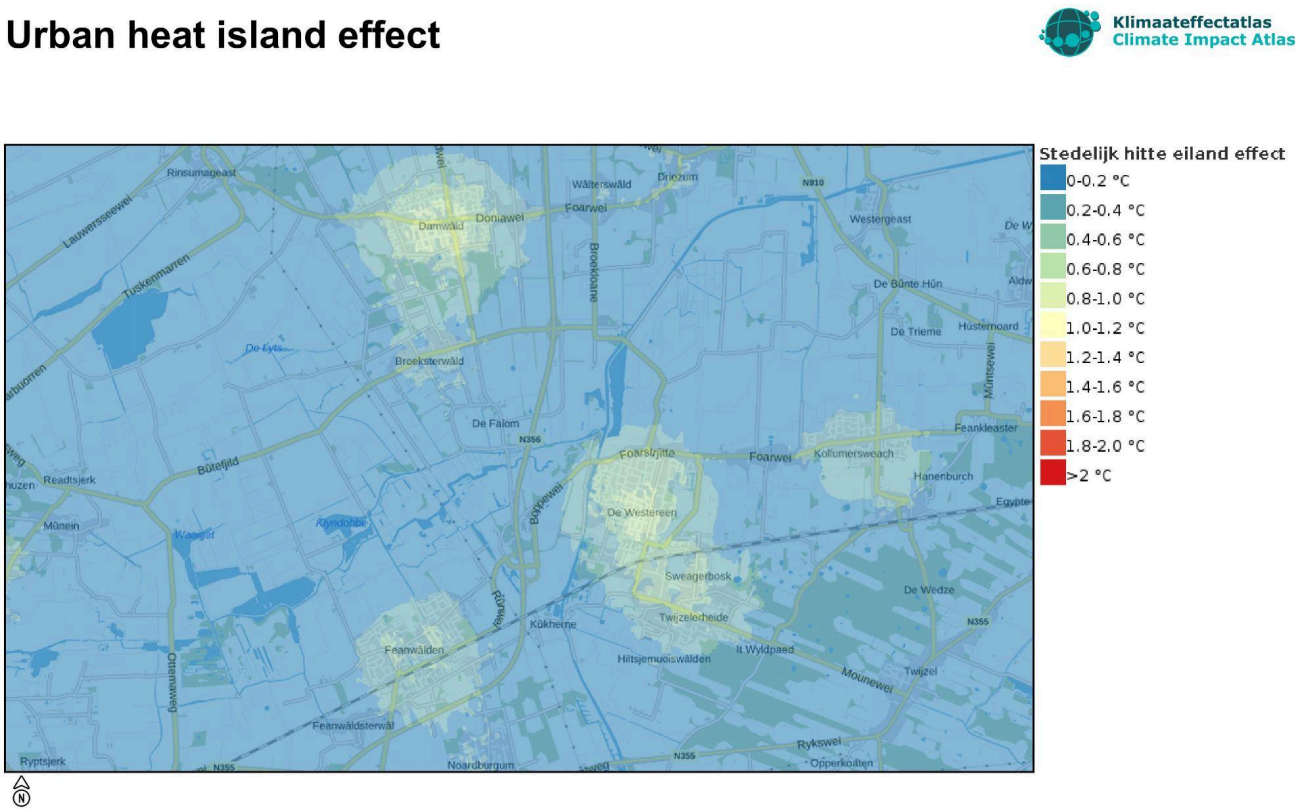

Figure 7: Figure displaying urban heating island effect in Dantumadiel (Klimaateffectatlas, 2024).

3.1.3. Global Discourse

Climate adaptation is not a challenge local to the municipality of Dantumadiel, the province of Fryslân, or even the Netherlands. How to adapt to the changing climate is a challenge which the entire globe is facing (Webber, 2016). Webber describes three important trends of climate adaptation: problematizations of vulnerability, the financial architecture of adaptation, and the tool of climate change mainstreaming. These three components lay the ground of answering the question of how adaptation works (Webber, 2016).

In addition to the discourse of what adaptation entails, the question arises if migration could be a component of adaptation. The intersection between adaptation and migration could be focused on international labour migration, and how climate change is influencing the motivations of migration, the ability of migration influences the vulnerability of an area to climate change and that it is perceived to be undesirable to migrate out of a country, but communities might have to relocate within their countries (Remling, 2020). Within this discourse, a paradigm shift has taken place, from seeing the migration as alarming, to optimistic, to now a balance between alarming and optimistic (Remling, 2020).

Lastly, a large component of climate adaptation is 'imagining the desired future' (Kanarp, Böhm & Löf, 2025). Despite increasing recognition of climate risks, there is a lack of adequate adaptation responses, which Kanarp, Böhm & Löf (2025) argues is partly due to how governance actors imagine the future. By utilizing imaginaries, governance regimes can be shaped to a more collective vision of climate adaptation. Kanarp, Böhm & Löf (2025) shows the power relation of using the business as usual approach of the current global dominant climate adaptation imaginaries and the stability of future societies and economies that is taken for granted. They argue for a critical examination of the interplay between different sociopolitical actors in adaptation governance. Imagining futures could be one avenue for increased community based participation. Community based adaptation is driven by a multitude of factors: recognition of the human dimensions of changes, appreciation of the role of local knowledge for strengthening adaptive capacity; and a push to focus on the scale at which impacts are felt and link this action with pro-poor development outcomes (McNamara & Buggy, 2017). Climate adaptation is a social process, focussing on innovation and multi - sectoral.

3.2. Historical and Geographical Background of Dantumadiel

The earliest recorded mention of Dantumadiel dates back to 1242. During this period, it functioned as a local administrative unit governed by a mayor, with administrative centers in Rinsumageast and Dantumawâld. This structure persisted until the Dutch Municipalities Act of 1851 transformed the government structures into municipalities in the form which is known today, introducing a standardized municipal governance system across the Netherlands (Gemeentelijke Informatiegids, n.d.).

Throughout its history, Dantumadiel underwent several territorial changes. In 1350, the area around Kollum separated to form Kollumerland. Later, Dokkum annexed parts of Dantumadiel to facilitate its expansion. A significant municipal reorganization in 1984 resulted in the transfer of the villages Birdaard and Jannum to the municipality of Ferwerderadeel (Gemeentelijke Informatiegids, n.d.).

In the 21st century, Dantumadiel engaged in administrative collaborations to enhance efficiency. In 2015, it entered into a cooperative agreement with neighboring municipalities, culminating in the formation of the Noard-East Fryslân municipality in 2019. However, Dantumadiel chose to maintain its political independence while sharing administrative services. This arrangement faced challenges, leading to its termination in 2024 due to issues like divergent policy directions and administrative inefficiencies (Binnenlands Bestuur, 2023).

3.2.1. Political Background

The municipality of Dantumadiel, located in the province of Fryslân, Netherlands, has a rich political history that reflects broader regional and national developments. Politically, Dantumadiel has experienced various coalition formations. In 2014, a coalition comprising the CDA, ChristenUnie, and FNP was established, emphasizing community engagement and

adaptability to decentralization (RTV NOF, 2014). By 2018, a new coalition formed by Gemeentebelangen Dantumadiel, Sociaal Links, and ChristenUnie introduced the "Ús Dantumadiel" agreement, focusing on citizen-centric governance (Gemeentebelangen Dantumadiel, 2018). In 2022, these parties, along with the SGP, continued their collaboration, highlighting priorities such as housing, administrative restructuring, and social welfare (SGP Dantumadiel, 2022). As of November 18, 2024, Anja Haga of the ChristenUnie serves as the acting mayor of Dantumadiel. The municipal executives include at the beginning of 2025, Rommy Kempenaar (Sociaal Links), Gerben Wiersma (ChristenUnie), and Kees Wielstra (Gemeentebelangen Dantumadiel), reflecting the municipality's commitment to collaborative governance.

In 2025, the municipality of Dantumadiel experienced a political shift with the collapse of its governing coalition. Internal disagreements began to surface, particularly concerning the budget allocations. In the aftermath, Dantumadiel faced a period of political uncertainty, with interim measures implemented to ensure continuity of governance. The municipality's experience emphasizes the need for alignment in policy objectives and collaborative decision-making.

3.2.2. National Adaptation Plan

In the governmental context of adapting to climate change for the municipality, there are many governmental levels working with local initiatives and other stakeholders. On the national level, there is the National Adaptation Plan (NAP). During the Conference of the Parties (COP) in 2017, the initial guidelines for NAPs were formulated (UNFCCC, 2024). These plans identify medium and long-term adaptation needs and help to develop implementation strategies for Global North and Global South countries (UNFCCC, 2024). According to the United Nations Framework Convention on Climate Change (UNFCCC) (2024), the goal of NAPs is to try to

reduce the vulnerability to the impacts of climate change by building the adaptive capacity of the nation and increasing resilience. Another goal of NAPS is to facilitate the integration of climate change adaptation into relevant new and existing policies, programs, and activities, particularly development planning processes and strategies, within all relevant sectors and at different levels (UNFCCC, 2024).

The guiding principles of the NAPs are to undertake action following the COPs and to follow a country-driven, gender-sensitive, participatory, and transparent approach, whilst considering vulnerable communities and ecosystems (UNFCCC, 2024). NAPs need to be based on the best available science, take into account indigenous knowledge, and integrate relevant social, economic, and environmental policies if needed. This is no easy task for nations, fortunately, there are some funds available through the Green Climate Fund, the Least Developed Countries Fund, and the Special Climate Change Fund (UNFCCC, 2024). Additionally, nations can receive technical assistance from the Least Developed Countries Experts Groups (LEG), the United Nations, and through support programs (UNFCCC, 2024). The LEG also keeps track of the process of NAPs through an annual progress report and maintains an NAP Tracking tool, displaying the latest information on the implementation of NAPs (UNFCCC, 2024).

The Netherlands also has implemented a National Adaptation Plan, called the Nationaal KlimaatAdaptatie Strategie (NAS) (Ministerie van Algemene Zaken, 2024). The NAS contains adaptation plans for the sectors of agriculture, health, and infrastructure, and plans that these sectors can take to combat climate risks (Ministerie van Algemene Zaken, 2024). Next to the NAS, the Netherlands has another plan to adapt to Climate Change, namely the Deltaplan. This plan takes a look at the consequences of flooding and freshwater reserves, and ensures a sustainable layout of the Netherlands (Ministerie van Algemene Zaken, 2024). Examples of the

Deltaplan can be reinforcing the Dykes, enlarging the freshwater reserve in the Ijselmeer, and placing Wadis in urban spaces. Wadi stands for a green ditch in Urban space (Boogaard, 2020). A Wadi is a green infrastructure that stores and filters the rainwater, after which the water gets absorbed in the groundwater, see for example figure 8.

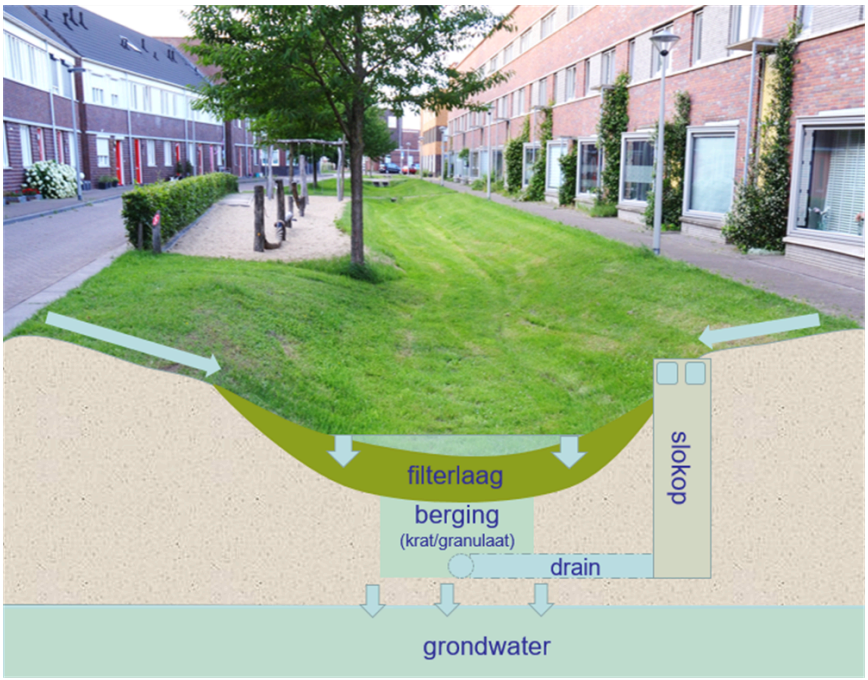

Figure 8: Example of a Wadi in an urban area (Boogaard, 2020).

The NAS and the Deltaplan are divided by sectors, and not by geographical location. This paper aims to identify the aspects of these plans that apply to the municipality, together with other plans and tools available from other layers in the governance system in the Netherlands.

3.2.3. Stakeholders in Climate Adaptation Dantumadiel

In the Netherlands, there are many different governmental stakeholders in place in regards to climate adaptation. There is a unique governmental body in charge of the water,

namely the waterboards (Ministerie van Algemene Zaken, 2024a). This governmental body is in charge of the water management of a certain area. It ensures that the inhabitants have sufficient and clean water. They are also tasked with the protection against too much water, e.a. Flooding (Ministerie van Algemene Zaken, 2024a). The waterboard maintains the water levels with sluices or pumping stations, cleans the sewages, maintains the dykes and nature in/around the water and lastly controls the swimming waters (Ministerie van Algemene Zaken, 2024a). There are twenty-one waterboards in the Netherlands (Waterschappen, 2024). The municipality of Dantumadiel falls under the waterboard Fryslân (Waterschappen, 2024). They have tight connections with other stakeholders, such as Rijkswaterstaat, the provinces, municipalities, and the drinking water companies (Ministerie van Algemene Zaken, 2024a). Their main sources of income are taxes, which enable them to execute their responsibilities. These taxes are a water system tax, a water cleaning or pollution tax, and five water boards also have a road tax in place (Ministerie van Algemene Zaken, 2024a).

The national government also plays a role in water management. The so-called "Rijkswaterstaat" has the national responsibility for the water (Ministerie van Infrastructuur en Waterstaat, 2024). They work closely with the waterboards, however, Rijkswaterstaat takes responsibility for the bigger bodies of water (Ministerie van Infrastructuur en Waterstaat, 2024). They also have a variety of other responsibilities that do not lie within the scope of this research.

On a more regional level, the province is also a stakeholder in water management. They are responsible for the translation from national water policies to a local scale (Ministerie van Infrastructuur en Waterstaat, 2024). They also have the responsibility for the groundwater levels and their qualities (Ministerie van Infrastructuur en Waterstaat, 2024). However, they also have a close collaboration with the water boards. For a stakeholder map of the multi-level governance

of climate adaptation in the municipality of Dantumadiel, look at figures 9 & 10. To conclude, there are many stakeholders in the municipality of Dantumadiel in regards to climate adaptation.

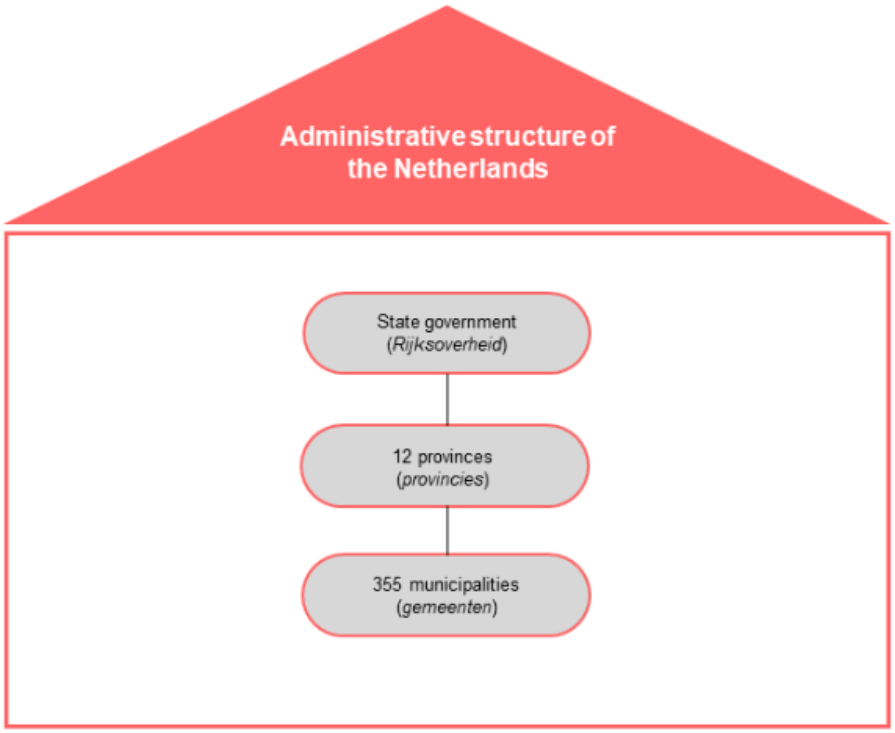

Figure 9: The administrative structure of the Netherlands in a three-layered system (ARL-International, 2021).

Planning level	Planning instrument	Content of plan	Legal basis	Policy maker	Legal impact	Scale
National	National structure plan (*structuurvisie*)	Presents the main aspects of spatial policy at the national level	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	State (government ministry)	Non-binding	State
National, provincial and municipal	Project plan (*projectplan*)	Facilitates the approval of developments that contradict existing land use plans	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	State, province or municipality	Binding; take precedence over land use plans (see below)	Dependent
Provincial	Provincial structure plan (*structuurvisie*)	Presents the main aspects of spatial policy at the provincial level	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	Province	Non-binding	Province
Provincial	Rural development plan (*landinrichtings-plan*)	Land-use plan for rural areas with low development pressure	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	Province	Non-binding	Rural area within a province
Municipal	Municipal structure plan (*structuurvisie*)	Presents the main aspects of spatial policy at the provincial level	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	Municipality	Non-binding	Municipality
Municipal	Local plan (*bestemmings-plan*)	Sets out where development may take place, what may be built, size of development and what it may be used for	Spatial Planning Act, 2006 (*Wet ruimtelijke ordening, Wro*)	Municipality	Binding	Municipality

Figure 10: The planning system of the Netherlands and the content (ARL-International, 2021).

3.2.4. Barriers

Adapting to climate change in the municipality of Dantumadiel is not without its barriers. While specific studies on Dantumadiel are limited, research focusing on the Netherlands and similar regions highlights some themes in barriers, such as institutional and governmental barriers, financial constraints, knowledge gaps, and cultural barriers. The governmental barriers could include conflicting interests or other priorities (Biesbroek, Klostermann, Termeer & Kabat, 2011). Due to the multiplicity of stakeholders in the area of water management, there could be

policy fragmentation. One level of government could contradict the other level, creating obstacles to cohesive adaptation (Moser & Ekstrom, 2010). Another well-known barrier is the financial constraints, as insufficient funding influences both the planning and implementation phases of adaptation strategies (Biesbroek, Klostermann, Termeer & Kabat, 2011). Additionally, a lack of knowledge on a localized level can reduce the development of adaptation (Barnett, Waters, Pendergast, & Puleston, 2013). This can also influence the public perception of adaptation strategies, which can either benefit the implementation or be a possible barrier (Biesbroek, Klostermann, Termeer & Kabat, 2011).

Addressing these barriers requires more research, close collaboration between stakeholders and governmental levels, as well as financial funding and public understanding.

4. Methods

To investigate the topic of climate adaptation in the municipality of Dantumadiel, the study employs a realist epistemic perspective, which entails that a look at reality is taken by researching independent mindsets on this topic. This allows the researcher to investigate both results and the underlying structures that produce them, with an underlying assumption that the knowledge is present and discoverable. A qualitative research approach is going to be utilized to explore experts operating across different levels of governance perspectives, with an emphasis on salinization, subsidence, and groundwater levels. The interviews will be conducted in a semi-structured format. The research is focused on the municipality of Dantumadiel, which allows for an in-depth analysis of the local challenges and adaptive strategies. Interviews with policy makers are conducted due to their insights into the acceptability, willingness to discuss and knowledge of climate adaptation.

4.1. Participants

The participants in this research are purposely sampled to ensure a comprehensive representation of expertise on the topics. In the first stage of the interviews, the responsible municipal council will be approached for a primary interview. The other experts will be selected by some selection criteria, such as distance to the municipality and availability of participants. The participants will be grouped into two categories: field experts and policymakers. The field experts are from different governance levels, such as the national government of the Ministry of Infrastructure and Water State, who provided a written statement, the province, and other municipalities, including the municipality of Noard-East Fryslân, Ljouwert, and Tytsjerkstradiel.

The participants of the policy makers include the parties of Sociaal Links, Gemeente Belangen Dantumadiel, Christen Unie, SGP, CDA, and the FNP. In total, twelve participants were included in this sample.

4.2. Interviews

Semi-structured interviews were conducted to allow for flexibility during the interview, whilst also ensuring the coverage of the topics. An interview guide was developed based on a review of relevant literature and input from preliminary consultations with the municipality, and adapted for the policymakers' interviews based on the expert input. The key topics discussed in the interviews are the adaptation plans to salinization, subsidence, heat stress, ground types, precipitation, and groundwater level changes, and the expert's view on the perceived adaptability in the municipality of Dantumadiel. Additionally, interviews with policymakers are more aimed at identifying the main barriers to adaptation and the interaction between governance levels and other stakeholders. The interviews are conducted in person, online, or on the phone, depending on the participants' preference, for a minimum of 30 minutes to a maximum of an hour, depending on the availability and preference of the participants.

4.3. Ethical Considerations

Ethical approval was obtained from the Ethical Committee of Campus Fryslân, University of Groningen, through the supervisor of this thesis project. Additionally, all participants signed an informed consent agreement, indicating that they had understood the purpose of the study. The interviewer highlighted the voluntary basis of participation, the right to revoke their consent at any time, the right not to answer questions they were not comfortable answering, and the undertaking of confidentiality measures. Lastly, the participants were allowed

to revise their transcripts. All interviews were audio-recorded with the participants' permission and later transcribed for analysis.

4.3.1. Positionality

The positionality of the researcher influences the data received as well as the data analysis. Sultana (2007) argues that good ethical practice includes attention to reflexivity, positionality and power relations. As this research takes into account politics, inequalities and a global discourse, a positionality of a researcher is included to increase the ethical practice.

This researcher is an inhabitant of the municipality under investigation. This has contributed in locating the research gap, however, there could have been a prejudice already present when investigating the political opinions of parties. This was mitigated by having a baseline of topics to discuss in the interviews. In addition to this, the interviews also included questions about the perception of parties and whether or not this could be confirmed or adjusted. In addition to this, the participants could have given into the social desirability bias. Social desirability bias refers to the tendency of participants to give socially desirable responses instead of choosing responses that are reflective of their true feelings (Grimm, 2010). The researcher came to investigate a climate related topic, some policymakers could have given a more nuanced answer than in an interview focused on the municipality in general. The field experts could have focused more on the problems their municipality faces which could be helpful to the research as they were very invested in the enthusiasm of the researcher.

4.4. Data Analysis

To analyze the data, a thematic analysis approach was employed to identify patterns and themes within the interview data. The analysis follows four steps:

1. Familiarization: The researcher familiarized themselves with the transcripts by reading and re-reading to ensure a deep understanding of the collected data.
2. Coding: Data were systematically coded using qualitative data analysis by the researcher based on the recurrence of topics. The coding will be done through a deductive approach.
3. Theme Development: Codes were grouped into themes based on recurring patterns and relationships.
4. Interpretation: Themes were interpreted in the context of the research questions and existing literature. These can be found in the findings.

To analyze the data from the interviews with the politicians, a discourse analysis was conducted. Discourse analysis is concerned with how language is used to construct meaning, identity, and social relations (Gee, 2014). It goes beyond the surface content of speech to examine the structures, patterns, and functions of language in context (Fairclough, 1995). In this study, six semi-structured interviews were conducted with local politicians. These interviews were transcribed verbatim and analyzed through a critical discourse analytical lens, focusing on how climate adaptation, priority of adaptation, and multilevel governance were framed by the interviewees. The analysis considered rhetorical strategies, recurring themes, and the positioning of actors (e.g., municipalities, waterboards, the national government). But attention was also paid to how the interviewees referenced policies or public narratives between the literal wordings.

The goal was to identify dominant discourses and potential conflicts surrounding climate adaptation in the municipality.

This method was selected to capture the complex interplay between language, ideology, and institutional structures, which is particularly relevant when studying political responses to climate and environmental issues.

4.5. Expected Results

This research is expected to find better insights into the current plans of the municipality on climate adaptation, what the surrounding municipalities' initiatives are to handle climate adaptation, and the barriers in the adaptation process. On the different levels of governance, this research expects to find a balance between collaborations and struggles of responsibilities.

It is expected that the knowledge of climate adaptation among politicians is limited; there might be some interchangeability between climate mitigation and climate adaptation. The barriers that are expected before the interviews are related to political will, knowledge among politicians, financial funding, and a complex governmental field.

4.5.1. Anticipated Dissemination and Impact

The results of this study will be mainly disseminated to the participants, the academic supervisors, and interested actors from the municipality. In the wrap-up phase of the study, a discourse analysis was conducted in cooperation with the thesis supervisor to look at potential publications. When this avenue is pursued, the results will be published in peer-reviewed journals focused on climate adaptation, environmental management, and governance.

The dissemination to participants will be through a tailored report that summarizes the key findings and recommendations. Additionally, the report will be shared with policymakers as per their requests.

The dissemination in the academic network will happen through publication in the thesis archives of the University of Groningen, as well as the Campus Fryslân Conference on the 26th of June, 2025, and the thesis defense on June 26th, 2025.

The potential impact of the study lies in its potential to inform evidence-based policymaking. The research highlights the need for localized research on the challenges and practical implications of adaptation strategies. This paper aims to take steps towards bridging the gap of the limited publications on the municipality of Dantumadiel.

5. Results

5.1. Municipality of Dantumadiel on Climate Adaptation

The municipality of Dantumadiel focuses on direct issues that the municipality faces, including the climate after an extreme weather event. However, the issue is still seen as a problem for the long term, and actions are mainly taken in the short term. The municipality is undertaking action on working on a strong water management system, with improved sewage systems that separate the clean rainwater and the sewage from households, which is seen as the crucial solution for a climate-adaptive Dantumadiel and the most far reaching option that was being presented at the time. The areas for improvement are identified through listening to the inhabitants and tools such as the Klimaat Atlas. Community based participation is still slim, as turnout surrounding the municipal sewage plan was small. Additionally, they are working on more green in the municipality, especially in newly built neighborhoods. Some challenges they face are the collaboration between governmental layers, as sometimes it is not clear who's responsible for what issue, and how not to make one's problem an issue for another. The responsibility ties in with the funding, as the financial resources are a constraint on implementing more climate-adaptive measures. The municipality is dependent on the government for funding, and the responsibilities to be paid from this money have been growing with time, making it more difficult to free up investment money for climate adaptation. However, the contacts between municipalities and the province on climate adaptation and water are good, and collaboration between disciplines is seen as essential.

5.2. Different Governmental Layers on Climate Adaptation

For this thesis, interviews on multiple levels were conducted. On the national level, the researcher was referred back to the Delta Plan, the Nationale Adaptatie Plan (NAP), and the website of the ministry (Ministerie van Algemene Zaken, 2024). The NAS outlines long-term goals for climate resilience, emphasizing a society adapted to climate change by 2050 through integrated adaptation in all policy sectors (Ministerie van Algemene Zaken, 2024). The Delta Plan, introduced in 2018, operationalizes this vision at the regional and local levels. It promotes seven key ambitions, including risk dialogues, stress tests, and spatial planning that accommodate water and heat challenges (Deltaprogramma Ruimtelijke Adaptatie, n.d.a.). Municipalities, provinces, and waterboards are mandated to collaborate on concrete implementation measures. The Delta Plan also integrates climate adaptation into broader urban development and sustainability agendas. Together, these frameworks enable proactive adaptation, reducing vulnerability to floods, droughts, and heat, while ensuring a livable environment for future generations.

Another governmental layer interviewed in this thesis is the Province of Fryslân. The participants from the province introduced the regional water program and the Frisian Administrative Agreement on Water and Climate 2021-2025. The Frisian Administrative Agreement on Water and Climate 2021 - 2025 outlines collaborative efforts among the Province of Fryslân, Wetterskip Fryslân, Vitens and municipalities to address climate adaptation challenges. Key aims include enhancing water safety, ensuring sufficient and clean water, and increasing resilience to climate impacts such as flooding and drought. The agreement emphasizes integrated spatial planning, sustainable land use, and active stakeholder engagement. It aligns with national strategies, promoting coordinated actions to safeguard the region's environmental

and socio-economic well-being amid changing climatic conditions. The regional water program focuses on climate adaptation, flood prevention such as separating the sewage system into rainwater and sewage from homes or wadi's, water quality, and sustainable use. Key objectives include increasing water retention, improving water systems' resilience, enhancing biodiversity, and aligning spatial planning with water challenges. The program emphasizes collaboration among governments, citizens, and stakeholders to address drought, heavy rainfall, and groundwater depletion, ensuring water resilience by 2050 through integrated, area-specific approaches and innovative solutions.

In the interview, the province also indicated that they are a governmental layer between the national government and the municipalities. The provincial government functions by setting up borders in rules for the municipalities. They do this by translating the national plans to the local needs. Sometimes this means that the provincial government is facilitating the discourse, and other times, they are initiating projects. The province works closely together with municipalities, especially when it comes to climate adaptation as this topic is wider than the borders of a municipality. They made collective agreements on how to combat climate change, adapt to the changes in precipitation, and ensure clean drinking water.

Since 2018, climate adaptation has become a higher priority in the province, as the consequences of climate change became very evident due to a prolonged drought. The participant mentioned that this theme comes back in a lot of political parties' plans, especially when it comes to the location of these measurements. In their experience, there is no discussion on whether the measures need to be implemented, but more on where, and how much funding needs to be allocated.

The responsibility for adaptation is being taken by all the parties involved by having regular meetings and making clear agreements before undertaking actions.

5.2.1 Other Municipalities on Climate Adaptation

Participants from various municipalities emphasized the value of an integrated approach to climate adaptation. This strategy involves aligning climate resilience measures with existing or planned infrastructure projects to maximize efficiency and cost-effectiveness. Common examples included combining sewage system upgrades with the separation of rainwater and wastewater systems, or restoring historic waterways during the development of new urban environments. This integrative method was generally perceived as practical and sustainable, as it allows for the concurrent realization of climate goals and broader spatial planning objectives.

However, a contrasting viewpoint emerged from one participant representing the municipality of Leeuwarden. This participant cautioned against the administrative and financial burdens associated with integrated approaches, particularly in contexts where extensive coordination across departments and governmental layers is required. They advocated for the establishment of a dedicated pillar or programme in policy making for climate adaptation within local government structures, arguing that this would enhance focus and streamline implementation processes.

While most participating municipalities were reported to be in similar stages of climate adaptation development, those with larger urban centers, such as Leeuwarden, were generally more advanced and actively engaged. Across the board, municipalities tended to frame climate adaptation primarily as a water-related issue. This includes challenges related to excess precipitation, rising groundwater levels, and water safety. Only one participant independently

mentioned heat stress as a critical dimension of climate adaptation, suggesting that this aspect may be underrepresented in local planning discussions.

In terms of intergovernmental coordination, participants largely expressed satisfaction with current collaboration mechanisms on water resilience. Effective communication between municipalities, provinces, and waterboards was frequently cited as a strength. Nevertheless, one participant noted that similar frameworks should be extended to other facets of climate adaptation, such as urban heat management and biodiversity, to facilitate a more holistic exchange of knowledge and strategies. This reflects an emerging consensus on the need for broader institutional integration in the face of complex climate challenges.

5.3. Political Views on Climate Adaptation

All interviewed political parties within the municipality of Dantumadiel acknowledge the importance of climate adaptation. However, there is variation in the depth of knowledge on the topic, particularly concerning the local soil composition and its implications for adaptive strategies. A notable observation was the general confusion between climate adaptation and mitigation, with most parties primarily emphasizing precipitation-related changes.

Parties such as the ChristenUnie (CU) and Staatkundig Gereformeerde Partij (SGP) framed climate responsibility through a stewardship lens, underscoring a moral obligation to care for creation, both as a duty inherited from God and as a legacy for future generations. Sociaal Links, in contrast, placed climate adaptation highest on its political agenda, proactively and consistently advocating for its inclusion in policy discussions.

Other parties expressed a more pragmatic approach, seeking to integrate environmental measures, such as improvements to biodiversity, water safety, and sewage systems, when

opportunities arise within broader projects. Nonetheless, the financial limitations of a small municipality like Dantumadiel prompt continuous trade-offs between climate adaptation and other pressing domains, such as social services. Interviewees indicated that public or political prioritization of climate issues tends to increase in the aftermath of crisis events, suggesting a reactive rather than proactive policy environment. One of the participants highlighted the general "Ad hoc" approach of governing in the municipality, not only in the area of climate adaptation.

Despite these constraints, all parties expressed general satisfaction with the information provided by the municipal council on climate adaptation. They also valued the intergovernmental collaboration with provincial and national actors. Still, there is room for improvement in communication flows, especially regarding the distribution of financial responsibilities across governance layers and among municipalities.

6. Discussion

For a small to medium-sized municipality like Dantumadiel, several policy strategies are viable for adapting to climate change, particularly focusing on subsidence, groundwater shortages, and salinization. One effective policy could be the promotion of adaptive land use through subsidies for converting vulnerable peat areas to wetland or nature-based solutions, mirroring successful examples in municipalities such as De Fryske Marren, or an example in ‘it Butenfjild’. Another opportunity lies in localized water buffering systems and groundwater recharge initiatives, which align with provincial-level ambitions and can be co-financed through European programs like LIFE Local Adapt.

6.1. Climate Adaptation in Governance

Currently, Dantumadiel has not implemented a comprehensive local climate adaptation plan beyond water-related collaborations through Wetterskip Fryslân and the province. Its main efforts remain fragmented, and the termination of its administrative collaboration with Noard-East Fryslân in 2024 suggests challenges in maintaining policy continuity and knowledge exchange. Compared to similar municipalities that are part of regional adaptation alliances, Dantumadiel lags in systematic intermunicipal communication on non-water-related climate issues, such as heat stress or soil degradation, however, this could be set up as other municipalities have shown interest in such a collaboration.

6.2. Risk Analysis

A thorough risk analysis reveals a complex vulnerability profile: severe subsidence risk due to peat soils, ecological stress from groundwater decline, and long-term salinization threats

in areas like “It Bûtenfjild.” Although flooding risk is relatively low in the current projections of 2050, the indirect risks, such as damage to foundations, infrastructure stress, carry high probability and potential costs. This calls for a spearpoint policy focus on soil and water systems, especially peatland rewetting, adaptive agriculture, and underground infrastructure resilience.

6.3. Political Views

However, Dantumadiel faces several limitations. Politically, the recent coalition collapse in 2025 illustrates the fragility of governance continuity, especially in the long-term visions needed for climate adaptation. Financially, the municipality is dependent on provincial, national, or EU-level funding, as its budgetary room is limited. Additionally, expertise in climate adaptation as opposed to mitigation among the municipal council is low. Although Dantumadiel has some awareness of adaptation, there is still confusion between adaptation (adjusting to impacts) and mitigation (reducing emissions). Unlike mitigation, which benefits from national targets and centralized knowledge, adaptation is decentralized, context-specific, and less well understood by local stakeholders.

Public support and local engagement are moderate. While nature and landscape are central to local identity, adaptation actions like groundwater tax increases or zoning changes face resistance. Communication strategies should therefore shift from reactive consultations to proactive co-creation. This approach is gaining traction in other Frisian municipalities, such as the municipality of Leeuwarden. Establishing a local Adaptation Council with citizens, farmers, and technical experts could help democratize adaptation planning, improve legitimacy and acceptability among inhabitants.

6.4. Intergovernmental Layers

Lastly, intermunicipal collaboration could address Dantumadiel's knowledge and resource gaps. Shared technical capacity, joint scenario modelling, and aligned funding applications for EU programs can increase the feasibility and efficiency of actions, especially outside the water domain. Nevertheless, legal fragmentation and differing political priorities pose coordination risks. The municipality has shared the importance of prioritizing active stakeholder engagement, which is in alignment with the paper of McNamara & Buggy (2017) that stresses the social, innovative and multi - sectoral aspect of climate adaptation.

6.5. Climate Adaptive Actions

In the interviews, it became evident that the main focus of climate adaptation lies with the water and the consequences of the fluctuation in precipitation, as already elaborated above. Unfortunately, this does mean that other topics of climate adaptation are snowed under. The risk analysis of the municipality of Noard-East Fryslân has indicated that even small urban areas, such as small villages, still have a heat island effect.

In sum, while the probability of successful adaptation in Dantumadiel is constrained by governance, technical and financial limitations, targeted, locally supported, and cooperatively financed policies offer feasible paths forward, especially if spearheaded through soil-water systems and underpinned by improved communication and institutional continuity.

7. Conclusion

This study demonstrates that while Dantumadiel faces real and increasing climate risks, such as soil subsidence, groundwater depletion, heat island effect and salinization, it also encounters significant institutional, financial, and political barriers to effective adaptation. The municipality's historical reliance on external governance (e.g., water boards, provincial leadership) constrains its capacity for long-term planning and implementation.

Nonetheless, this research identifies several pathways to improve local adaptation efforts. First, Dantumadiel should prioritize spearpoint policies that align with its specific vulnerabilities. A landscape-oriented strategy that addresses peatland degradation, for instance, could have a high impact if supported with cross-sectoral partnerships and external funding. Integrating such a policy into spatial planning and agriculture, while using tools from the national NAS or European Union adaptation programs, provides a clear route to local implementation.

Second, fostering intermunicipal cooperation, particularly on non-water related adaptation topics like biodiversity, heat stress, and drought, is essential. Dantumadiel's challenges are shared across the region, and mutual learning and resource-sharing can alleviate its capacity limitations.

Third, local communication and community based adaptation must improve as a large portion of land is privately owned. Support for adaptation is more likely when residents are informed and involved. Participatory planning processes and accessible messaging can cultivate local ownership and sustain political legitimacy in times of uncertainty.

Finally, a clearer distinction between adaptation and mitigation is needed in both policy language and execution. While carbon reduction is important, this should not be confused with

resilience investments. Local leaders must receive training and support to strengthen their knowledge and distinguish these goals.

Despite its small size and current limitations, Dantumadiel holds the potential to become a regional model for rural climate adaptation. Through focused, realistic policies grounded in local conditions and a pragmatic governance approach, it can begin to bridge the gap between national strategy and local action.

7.1. Limitations

This study offers valuable insights into climate adaptation efforts within the municipality of Dantumadiel, however, some limitations should be acknowledged.

First, the case study design limits the generalizability of the findings. Dantumadiel represents a specific socio-political, geographic, and ecological context, which may differ significantly from other small to medium-sized municipalities in the Netherlands or Europe. Therefore, conclusions drawn from this research may not directly apply to other municipalities facing similar climate challenges, as they are embedded in different governance structures or environmental conditions.

Second, although twelve interviews were conducted with a diverse range of stakeholders, including policymakers and field experts, the sample size remains limited. The voices included in the analysis may not represent the full spectrum of views within the broader stakeholder landscape, such as private sector actors, citizen groups, or water companies. Furthermore, due to practical constraints, a variety of responses were received. Such as a written statement, obtained from a national governmental level, online interviews, or in-person interviews, this might not fully capture the complexity of national-level strategy implementation.

Third, the interview data may be subject to response bias, especially from local politicians who may wish to present the municipality in a favorable light or respond more in favor of climate adaptation due to this being the topic of research. Although discourse analysis aimed to identify implicit meanings and rhetorical strategies, the influence of social desirability and political positioning cannot be entirely ruled out.

Finally, this study focused primarily on governance and planning perspectives, and less on the technical or ecological effectiveness of specific climate adaptation measures. This may have limited the depth of analysis regarding implementation feasibility, cost-efficiency, or environmental trade-offs.

Despite these limitations, this research provides a meaningful foundation for understanding the local governance challenges in implementing national climate adaptation frameworks.

7.2. Further Research

This study presents several opportunities for further academic and applied research on climate adaptation in small to medium-sized municipalities (SMS), particularly in the context of rural governance systems like Dantumadiel.

First, while this paper provides a grounded case study of Dantumadiel, comparative research across other Frisian SMS municipalities such as Achtkarspelen, Tytsjerksteradiel, Weststellingwerf, and Noard-East Fryslân could illuminate regional variation in climate adaptation strategies, institutional capacity, and political will. This could lead to the identification of transferable best practices and barriers specific to rural governance contexts.

Secondly, additional research could examine public perceptions and behavioral responses to climate adaptation measures in SMS settings. While this study focused primarily on political

and administrative perspectives, further research into citizen attitudes, especially concerning trade-offs in land use or climate stress, would provide a more complete understanding of the democratic legitimacy and feasibility of adaptation measures.

Thirdly, the potential for intermunicipal collaboration structures inspires a curiosity for deeper investigation. Although this study identified knowledge gaps and the value of shared initiatives, empirical evidence is still limited on how technical capacities, funding applications, and scenario modeling can be effectively coordinated across municipalities with differing priorities and resources on varying topics besides the watersystems.

Fourth, a longitudinal study tracking policy development and climate impacts in Dantumadiel could evaluate how adaptive capacity evolves, especially in response to extreme weather events or shifts in political leadership. This could support a dynamic understanding of resilience building in low-capacity contexts.

Finally, future research should look into the integrated approach that is mainly taken by many governmental layers on the topic of climate adaptation. Aiming to answer the question of whether this approach is more beneficial for the funding, or if the additional time spent on meeting and coordinating between different stakeholders and actors.

Expanding this research agenda will contribute to more robust, inclusive, and actionable adaptation pathways tailored to the realities of SMS municipalities.

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