Human-Nature relationships and the application of urban Nature Based Solutions a household scale

Exploring the relationship between ecological worldviews and the willingness of citizens in Leeuwarden to adopt climate change mitigation and adaptation measures in their private outdoor space.

M.Sc. Thesis

University of Twente.

Faculty of Behavioural Management and Social Sciences
Master of Environment and Energy Management – MEEM

By Isabel Samuilova
August 2023

Specialization: Environmental management

Educational Institution:

University of Twente

First Supervisor: Prof.dr. Michiel Heldeweg

Second supervisor: Dr. Steven R. McGreevy

Abstract

There is an undeniable consensus among scientists that cities must take actions to slow down and adapt to the progression of climate change. Nature based solutions (NbS), with green infrastructure as part of it, is a cost effective, nature friendly solution that is well suited for urban environments. Understanding the intricate connections between attitudes, behaviours, and policy preferences is crucial for combining both public and private interests together. This research focuses on the residents' contributions to urban sustainability, aiming to link ecological worldviews, as measured by the New Ecological Paradigm (NEP), with the implementation of green gardens and policy recommendations. Leaning on the Theory of Planned Behaviour (TPB) and the Contextual Interaction Theory (CIT), this study employed surveys and interviews to ask residents of Leeuwarden about their environmental beliefs and garden preferences. Findings reveal strong pro-environmental attitudes and willingness among participants, driven by both personal and ideological motivations. Nevertheless, for most of the respondents, willingness is not matched with implementation. Limited resources and knowledge were identified as barriers to implementing Nature-based Solutions (NbS). The research further provides pragmatic steps to bridge the gap between willingness and implementation, by providing policy recommendation based on theory and empirical findings. This research offers valuable information for policymakers aiming to foster greener cities and engage citizens effectively.

Keywords

Environmental Sociology, Nature Based Solutions (NbS), Urban sustainability, New Ecological Paradigm (NEP), Contextual Interaction Theory (CIT), Theory of Planned Behaviour (TPB), Gardening.

Acknowledgments

I'm proud to present my research thesis on a topic that I find both fascinating and important. I've enjoyed the process of reading, researching, analysing, and even the writing, despite the blockages and long days. Reflecting on this journey, I'm grateful for the opportunity to have pursued this study, which seemed to pass by surprisingly quickly.

I would like to begin by expressing my gratitude to both my supervisors for their input. I especially want to thank my first thesis supervisor, Prof. Dr. Michiel Heldeweg, for his invaluable guidance throughout the entire research process. Your feedback has been insightful, and your patience and collaborative approach have greatly enhanced the quality of this study.

A special word of appreciation goes to my supportive and caring boyfriend, Redmar Postma, who provided me with a care-free environment so I could focus solely on my thesis for days on end. To my cherished family, your continuous interest, and attentive ears always push me for improvement.

I extend my gratitude to all the survey participants who generously took a few minutes of their time to respond to my survey. Your contributions have played a vital role in shaping this research.

Lastly, I want to convey my sincere thanks to the municipality of Leeuwarden for their quick response, cooperation, and valuable input. A special acknowledgment goes to Bonny Veenstra for dedicating time to our interview, inviting me to events, and actively assisting in the recruitment of survey respondents.

Contents

Abstract ii
Acknowledgments iii
1 Introduction – Climate change and urban landscapes 6
1.1 Research objective 7
1.2 Research questions 8
1.3 Outline of the document 8
2 Literature review 8
2.1 Nature based Solutions as an umbrella term 8
2.1.1 Benefits of NbS in the Urban Environment 10
2.1.2 Current challenges with implementing NbS in Urban Environments 11
2.1.3 Parameters influencing sustainable urban garden management 11
2.2 Psycho-Social theories linking culture, values, norms and attitudes to Pro-Environmental behaviour 12
2.2.1 New Ecological Paradigm (NEP) 13
2.2.2 Theory of Planned Behaviour (TBP) 14
2.3 Contextual Interaction Theory (CIT) 15
3 Conceptual framework and hypotheses 17
4 Research Design and Methods 19
4.1 Study area 19
4.2 Data sources 19
4.3 Data collection 21
4.4 Survey Design and Analysis 22
4.4.1 Demographics section 22
4.4.2 Worldviews section 22
4.4.3 Willingness section 24
4.4.4 Action section 27
4.4.5 Policy section 28
5 Results 28
5.5 Survey 28
5.5.1 Sample 29
5.5.2 Worldviews 32
5.5.3 Willingness 34
5.5.4 Hypothesis 1 – NEP vs Willingness 36

5.5.5 Action 36
5.5.6 Hypothesis 2 – NEP vs Action 39
5.5.7 Policies 42
5.6 Interview 43
6 Discussion 44
7 Conclusions 47
7.1 Pro-Environmental Worldviews and Willingness: The Foundations of Change 47
7.2 Willingness and Action: Bridging the Gap 48
7.2.1 Preferred Policies: Navigating Motivation and Support 48
7.3 Recommendations 48
8 References 50
9 Appendixes 56
9.1 NEP statements 56
9.2 Survey 57
9.3 Interview questions 72

1 Introduction – Climate change and urban landscapes

Over the past three decades, climate change has gained global recognition, resulting in more frequent and severe extreme weather events that are becoming increasingly tangible. According to the IPCC Working Group sixth assessment report, the world will likely reach or surpass 1.5°C of warming within 20 years (IPCC, 2022).

The IPCC report on geographical zoning indicates that Friesland, which borders Northern Europe and Western & Central Europe, is expected, with high confidence, to experience more heavy precipitation, pluvial flooding, and rising mean surface temperatures. These projections, together with the geological conditions of Friesland, make it exceptionally susceptible to local flooding (Sari Kovats et al., 2014).

In 2018, 55% of the world's population lived in cities and these trends are expected to continue as cities continue to grow both in size and numbers in all regions worldwide. Europe's urban growth rate continues despite being one of the most urbanized continents in the world. According to the UN, already in 2018 74% of its population resided in urban environments. Zooming further into the Netherlands, in 2018, 92% of its area is already urbanized and is expected to reach 96% by 2050 (UN, 2018). Urbanization degree directly translates to sealed surface area. Followed by Malta, the Netherlands is the most "sealed" country on the mainland Europe with a rate of 8.23% (European Environment Agency, 2018a).

This trend places an especially important emphasis on speeding the recognition and application of urban sustainability concepts. Densification inside and outside the existing city perimeter replaces exposed soil with impermeable surfaces, aggravating the urban heat island effect and increasing flooding risks as a result. Urbanization further leads to loss of important natural habitats and speeds the rate of biodiversity loss. Therefore, intertwining nature and urban environment becomes imperative.

Governments and cities are already working towards becoming more sustainable by adopting mitigation and adaptation measures. In 2020, the municipality of Leeuwarden published its strategic plan to achieve climate safety by 2035. The plan's focus is to address flooding, drought, and urban heat, with a total budget of up to 37.8 million euro. In order to address upcoming urban heat, the municipality is mainly planning to use trees as cooling agents in public open spaces by adding more shadowed areas. Research indicates that trees are also effective at absorbing rainfall and can be used in conjunction with grey infrastructure for flood protection (Woods Ballard et al., 2015 Among the various measures discussed to tackle the three primary objectives, one less emphasized yet essential approach involves the removal of paved surfaces and the provision of subsidies to encourage the greening of gardens (Gemeente Leeuwarden, 2020).

The use of Green Infrastructure (GI), such as planting trees and gardens, is part of a general concept called Nature Based Solutions (NbS) - an umbrella concept that encompasses techniques such as reforestation, regenerative agriculture, ecosystem-based disaster risk reduction, and green infrastructure, which all draw inspiration from, or mimic nature's processes and systems, to tackle issues such as climate change, shifts in hydrological cycles, and loss of biodiversity.

What makes NbS unique is their ability to provide solutions that align with all three aspects of sustainability: environmental, social, and economic. They can also be implemented at various scales, from individual households to entire cities and rural areas, making their application accessible to both citizens and governments. Much scientific work has been devoted to the quantifications of ecosystem services provided by NbS, such as "water purification, air quality, space for recreation and climate

mitigation and adaptation". Both the UN and the EU union have already integrated them into their sustainability strategies for the coming decades (European Commission, 2020; UN Habitat, 2022). Yet, their local implementation rate remains low.

In the (peri-)urban areas of the Netherlands, private properties often make up more than half of the municipality's land. In the case of Leeuwarden, private properties represent up to 70% of the municipality's land (Gemeente Leeuwarden, 2020) If the municipality wants to reach its' targets, involving the citizens in the transition to urban sustainability is crucial. 'Greenification' of domestic gardens will significantly influence the overall sustainability of the city as a whole. Therefore, understanding how people design, view, and use these spaces will provide important information for policymakers on how to raise awareness and change behaviour, which will in turn assist in designing effective policies.

Understanding people's views, and ideally motivating them to engage in sustainable behaviour, requires a deeper understanding of their worldviews, values, norms and attitudes. The relationship between these concepts is dynamic, with beliefs and values shaping personal attitude towards a behaviour. Values, norms and beliefs are "deeply embedded in the social and institutional context" we are living in (Jackson et al., 2005). Meaning that our personal choices are partly shaped by our own experiences, by what others around us do and say ("social context)", and by which rules we are expected to operate ("institutional context") (Ajzen, 1991; H. Bressers, 2009; Jackson et al., 2005). This explains the important role subsidies and regulation play in steering people into pro-environmental behaviour. Another example is that positive experiences from encountering nature, urban or wild, are linked to increase of feeling of connection and willingness to support nature in general (Beatley, 2011) In the field of environmental communication, research shows that communication focused on topics that are closest to us, both figuratively and geographically, are most effective (Stoknes, 2014).

One of the most known scales for measuring an ecological worldview is the New Ecological Paradigm (NEP), which consist of a set of beliefs about how people view the effects of human interference with nature (Dunlap et al., 2000). If the goal is to increase awareness and positive behaviour about gardening, there is not a better place to start than people's own home. Therefore, there is a need to study why some citizens prefer paved gardens and what factors contribute to those choices.

In recent years, a growing amount of research focused on the concepts of Nature-based Solutions (NbS) in urban settings linking it to social, cultural, and psychological theories. However, in the Netherlands most studies examining urban environments tend to concentrate on large cities with populations exceeding 500,000. Additionally, these studies tend to prioritize the analysis of public spaces rather than private domestic spaces, with even fewer examples exploring the connections to nature values. What sets this thesis apart is its distinctive combination of these elements, along with the provision of a dataset from the city of Leeuwarden, while also testing specifically the application of the New Ecological Paradigm theory.

1.1 Research objective

This thesis will have two main objectives:

1) Obtain a clearer understanding of how people, either intentionally or unintentionally, support urban sustainability and biodiversity conservation through their private outdoor spaces.

2) Provide actionable recommendations for the municipality of Leeuwarden and policymakers to raise citizen awareness and promote effective implementation of NbS in private spaces.

1.2 Research questions

In order to provide answers to the research objectives above, the main research question guiding this thesis is:

How do pro-environmental worldviews influence homeowners in Leeuwarden to adopt climate change mitigation and adaptation measures, particularly those related to green gardens, in the scope of their own homes?

Followed by the following sub questions:

1. Does an ecological worldview influence *willingness*, and consequently implementation, of NbS in private gardens?
2. Which other factors influence *implementation* of NbS in private gardens?
3. What *strategies* can be employed to effectively promote and implement greener gardens in the context of Leeuwarden?

1.3 Outline of the document

Chapter 2 provides an overview of the key concepts related to the research topic, namely an overview of the concept of NbS and an overview of important models explaining social behaviour. Based on these concepts, a conceptual framework was developed and is explained in chapter 3. The explanation of the research design, including sources used, collection methods and analysis are found in chapter 4. Results of fieldwork, discussion thereof and conclusions and recommendations of this research are presented in chapter 5-8.

2 Literature review

2.1 Nature based Solutions as an umbrella term

One of the definitions for the concept of Nature Based Solutions was coined by The International Union for Conservation of Nature (IUCN) as: “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits” (Cohen-Shacham et al., 2016). The European Commission provided their own definition emphasising the underlying sustainability pillars and defined NbS as: “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services.” (European Commission - Research and innovation, 2023)

This broad definition results in many acronyms with similar concepts, all with varying understanding of what it means to “use nature”, while still falling under the same term of NbS (Cohen-Shacham et al., 2019). Figure 1 depicts these categories and the concepts that fall under:

- Restoration of ecosystems, forests, and landscapes – Ecological Restoration (ER); Ecological Engineering (EE); Forest Landscape Restoration (FLR)
- Address specific issues such as ecosystem-based adaptation, mitigation, and disaster risk reduction- Ecosystem-based Adaptation (EbA); Ecosystem-based Mitigation (EbM); Climate Adaptation Services (CAS); Ecosystem-based Disaster Risk Reduction (Eco-DRR)

- Establish natural and green infrastructure - Natural Infrastructure (NI); Green Infrastructure (GI)
- Manage ecosystems such as coastal areas and water resources - Ecosystem-based Management (EbMgt);
- Protection and conservation of existing ecosystem - Area-based Conservation (AbC).

Each of the subcategories above is focused on solving different aspects of climate change and can be applied in different scales. Some are more focused on adaptation, some more on mitigation. The lack of clear characterization of each of these concepts led to a situation where in some cases the same type of NbS solution, for example green roofs and gardens, were referred as both GI as well as EbA (Dorst et al., 2019). Several studies try to finetune the definitions and characteristics of each subcategory (Kabisch et al., 2015; Nesshöver et al., 2017). However, for the scope of this thesis, gardens will be defined under the more general term of NbS. This is because the objectives of both GI and EbA are closely related, namely, to provide climate change mitigation and adaptation measures using plants. Both categories can be implemented in various scales – from micro scales of a single building to a macro scale of a city level (Kabisch et al., 2017). In addition, the focus of this thesis is on the values and views that people assign to gardens rather than the applied techniques and ecosystem services received from the gardens.

Regardless of the category which they fall into, it is important to mention that gardens are recognized mainly for their adaptation advantages. Due to their sizes, most urban gardens don't have much carbon storage or sequestration capacity because they often lack, and cannot accommodate, large trees. Therefore, they cannot offer significant mitigation aspects (Kabisch et al., 2017). Nevertheless, green gardens provide important ecosystem services by transforming paved surfaces into exposed soil which allows infiltration of water, create cooler spaces using shade and evapotranspiration that reduce risks of heat waves and support declining biodiversity (Zölch et al., 2017) Zardo et al., 2017).

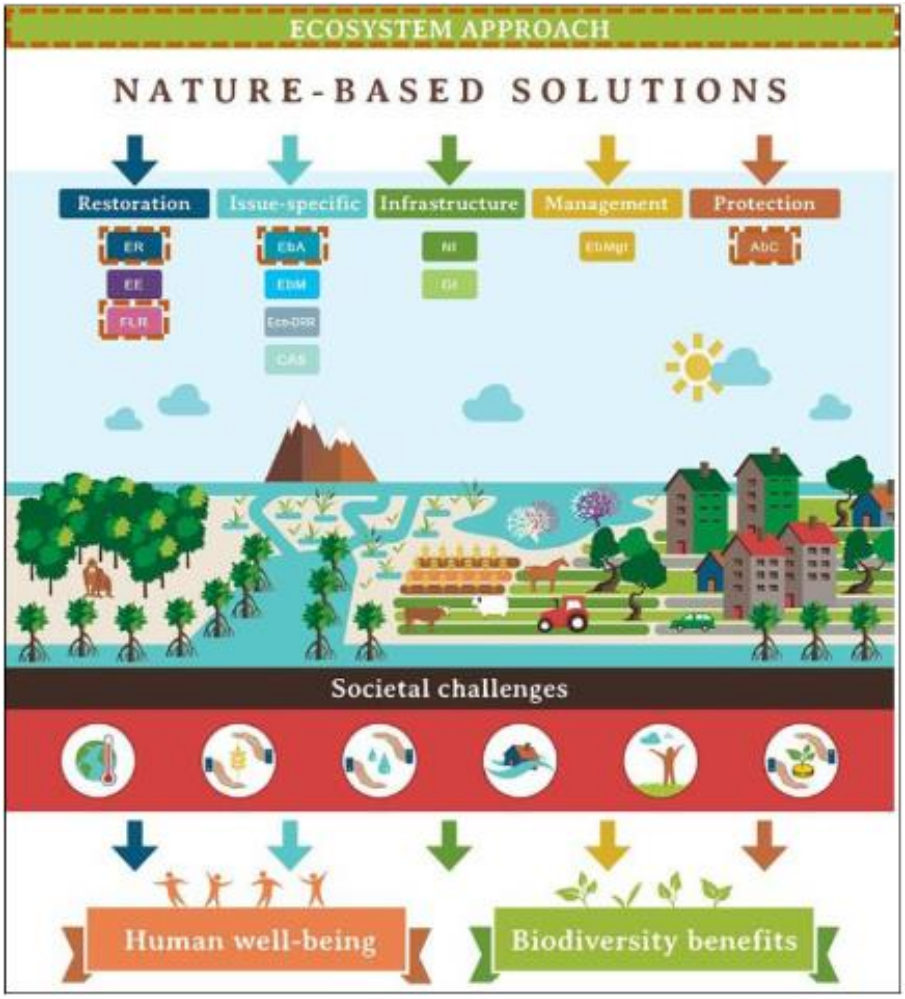


Figure 1: Depiction of different concepts of NbS separated by category. The societal challenges represented in circles are represent the ecosystem services NbS provide solutions to. Source: (Cohen-Shacham et al., 2019)

2.1.1 Benefits of NbS in the Urban Environment

All around the world, cities are growing in both number and size. At the same time, most of these cities are at risk of experiencing at least one type of natural disaster, such as floods, cyclones, earthquakes and volcanic eruptions. For cities along the coastline have the risk to experience even two or three types (United nations, 2018).

In dense cities competition for space creates pressure of green infrastructure and often results in a high percentage of sealed surface. Sealed surfaces prevent rainwater to permeate to the ground which in heavy rain periods, can cause flooding and overloading of the sewage system(Cui et al., 2021). In addition, sealed surfaces aggravate the urban heat island due to lack of tree- canopy coverage (Fokaides et al., 2016).

Using NbS in an urban environment, both the public as well as in the private domain, is a potential way to provide multiple benefits that increases the overall resilience and sustainability of a city. From an environmental perspective, in addition to reducing the risk of flooding and extreme temperatures, green spaces can improve air and water quality by acting as natural filters. Parks, green roofs and urban forests provide natural habitat for flora and fauna. This can support biodiversity conservation, improves ecological connectivity of segregated natural habitats (Green Infrastructure concept), and enhances urban ecosystem services, such as pollination or carbon sequestration(Beatley, 2011; Cohen-Shacham et al., 2016). Beyond environmental benefits, NbS

provide important social cohesion within the complex social network of a city. Public green spaces are designed for everyone, providing a place for meetings, recreation, sport, relaxation, connection to nature and other well and health-being aspects (Chen & Jim, 2010; Chiesura, 2004; WHO, 2021). From an economic point of view, green spaces, trees, and other natural elements can provide visual beauty, create a sense of place, and improve overall attractiveness of an area (Frantzeskaki, 2019). As a result, these elements often bring an increase in property values surrounding green infrastructure (Bockarjova et al., 2020; Dell'Anna et al., 2022)

2.1.2 Current challenges with implementing NbS in Urban Environments

Beside the positive outcomes that NBS are providing, they can also hold some disadvantages. NbS require space which is not always available in cities. The densification and land use in cities competes with the areas needed for the NbS. This can lead to displacement of local users and subsequently to conflicts of citizens with the municipalities (UN Habitat, 2022). Gentrification, a process of displacing citizens with lower economic abilities due to rising property prices in green urban areas, is such an example (Bockarjova et al., 2020).

There is a lack of knowledge by policy makers, and the step to large scale integration into urban planning apart from pilot projects is rarely made. Mainly the long-term effects are still unknown, which often deters implementation(UN Habitat, 2022). In addition, the concept is broad and so are the metrics that are required to measure the success in the long term (Dorst et al., 2019).

2.1.3 Parameters influencing sustainable urban garden management

Developing NbS requires collaboration of multiple stakeholders, such as community members and governmental officials, but also NGO's and private firms. Good governance throughout the entire design phase is critical. That includes participatory methods, involving multidisciplinary specialists and considering trade-offs such as gentrification and land use competition (Dorst et al., 2019). Local governmental organizations play an important role in shaping citizen's choices towards sustainable garden management, whether through subsidies, educational campaigns, supporting private initiatives and using public green spaces as examples.

From a design perspective, design characteristics of NbS, or more specifically aesthetics, can assist with better adoption by local community. Research on designing green roofs has found that the more aesthetic the roof is, the better it was perceived by the citizens and the better it was accepted and maintained (Vanstockem et al., 2018).

Considering the socio-demographic and socio-cultural characteristics of the community members provides important information regarding preferences and therefore increase the success rate of implementation. In Dutch research, it was found that ethnicity of the residents played a role in the choice of GI, especially with emphasis on practicality aspects. They found that "immigrants prefer functional landscapes while natives prefer wilder nature" (Derkzen et al., 2016). Multiple studies have examined the correlation between age, financial resources, garden size, ownership type (private or rented), educational level, and the degree of vegetation in household gardens. It was found that the most influential socio-economic characteristic was the size of the garden, followed by: owned houses, higher educational level and older age of residents. Interestingly, there is no consensus regarding the positive relationship between household income and vegetation variance (Lin et al., 2017; Meléndez-Ackerman et al., 2014). Rupprecht (2017) found similar results when comparing opinions of urban citizens in Brisbane, Australia and Sapporo, Japan. Neither income nor sex influenced general willingness to coexist with plants and animals in Sapporo or Brisbane. Both age and education were positively correlated, however to a limited extent (Rupprecht, 2017).

NbS are an important tool in achieving urban sustainability. They are very diverse, which makes them perfect to apply on a range of scales and most importantly, provide threefold of benefits: environmental, social and economic. Unknown long-term effects, lack of knowledge, stakeholder participation and measurement tools are, however, the main challenges that delay current implementation in the public and private spaces. The following chapter will provide an overview on internal motivations as another factor for facilitating the adoption of NbS.

2.2 Psycho-Social theories linking culture, values, norms and attitudes to Pro-Environmental behaviour

This section delves into the complex relationship between personal emotional and cognitive factors that impact the management of private gardens, specifically examining the extent to which environmental values influence people's decisions to have a de-sealed and biodiverse garden.Within the study area of Environmental Psychology and Sociology, numerous theories have been developed to understand how human motivations can promote environmental behaviour, acting as a tool for combating climate change. Emotions often guide our behaviours, even when we believe our decisions are based on conscious and rational thinking(Jackson et al., 2005). These emotions are continually shaped by our interpersonal communications, which, in turn, are influenced by the social structures we inhabit, creating norms, values, and attitudes that we may not always be aware of.

In fact, the idea of belief systems is omnipresent in social sciences. Leading theories, such as "*Moral Norm Activation*" by S. H. Schwartz (1972), Value – *Beliefs* – *Norms* (VBN) Theory (Stern et al., 1999), *New Ecological paradigm* (NEP) by (Dunlap et al., 2000) and *Theory of Planned Behaviour* (Ajzen, 1985), to name a few, tried to understand what drives people to take actions and participate in social movements. All four theories have a common ground, by using values, norms, beliefs attitudes (in different configurations and not necessarily all at once) as predictors of pro-environmental behaviour(Kim et al., 2023; Sharmin et al., 2020; Wang et al., 2023). *Personal norms* (the moral or ethical standards that individuals hold for themselves) and *altruistic values* (the belief in helping others without expectation of personal gain) are crucial to social movements because they require participants to demonstrate actions or behaviours that are based on morals or ethics, regardless of personal gain (Stern et al., 1999). The basic idea is that individuals that possess and identify with certain basic values and personal norms, are predisposed to exhibiting pro-environmental behaviour and support the environmental movement despite of their economic-demographic parameter (López-Mosquera & Sánchez, 2012). This finding was also confirmed in research on perception of animals and plants in urban environments in Brisbane, Australia and Sapporo, Japan. There it was found that cultural context influences norms and values and is therefore an important factor for increasing willingness of people to interact with plants and animals (Rupprecht, 2017).

Certain combinations of values, beliefs, norms and attitudes shape an individual's worldview. Based on the *Cultural Theory* (McNeeley & Lazrus, 2014), how people perceive risk of climate change depends on their worldviews and it can change over time based on experiences and contexts. Worldviews are defined as "general social, cultural and political beliefs toward the world and "orienting dispositions" that guide individual responses in complex situations" (Dake, 1991). When testing for factors influencing policy support, worldviews have shown to be the strongest predictor, surpassing political party affiliation or socio-demographic parameters (Leiserowitz, 2006). An individual related to an *Egalitarian* worldview is strongly associated with sensitivity and concern to environmental challenges, which also affects their support of environmental policies (Leiserowitz, 2006). This is strongly related to the fact that an egalitarian worldview supports the idea that nature is a fragile, delicate balance and is needs to be protected from human activities (McNeeley & Lazrus,

2014). Additionally, the theory suggests that individuals' behaviours and actions are influenced by their perceptions of the risks and benefits associated with different courses of action, so it may be helpful to understand how homeowners perceive the benefits and risks of adopting green infrastructure measures.

Values, rationales and principles of actors are also a metric for the rate of innovation adoption. Lifestyles, culture, and how cities, buildings and spaces are perceived etc., translate into the norms and actions of the actors. Therefore, they can be either the barrier or the driver for adoption (Dorst et al., 2021).

In other words, understanding if citizens associate themselves with an egalitarian, eco-centric worldview can tell a lot about their willingness to transform their private spaces into green gardens. In the context of Leeuwarden, positive attitudes towards of nature may include appreciation for the beauty of natural landscapes, recognition of the importance of ecosystem services, and concern for the impacts of climate change on the environment.

2.2.1 New Ecological Paradigm (NEP)

The New Ecological Paradigm (NEP), a scale that represents a holistic and ecologically oriented worldview, is the most frequently used measure for environmental concern (Clayton & Myers, 2015; Stern et al., 1995). Originally published under the name of “the New Environmental Paradigm” it was released in 1978 by two sociologists - Riely Dunlap and Kent van Liere. In 2000, Dunlap released a revised scale under the name of “the New Ecological Paradigm” and apart from the slight change in naming he also updated some of the content. This research uses the new and updated scale, which has become the most widely used measure to assess people’s environmental attitudes (Hawcroft & Milfont, 2009). In its core, the NEP is a tool to measure individuals' environmental attitudes and beliefs towards an ecological and *Eco-centric worldview* that emphasizes the interdependence of humans in the natural environment, and that addressing environmental challenges requires a fundamental shift in how we perceive and interact with nature (Dunlap et al., 2000; Dunlap & Van Liere, 1978).

The revised NEP scale consists of a set of 15 statements that individuals can score on a 5-point Likert scale from “strongly agree” to “strongly disagree”, reflecting their environmental attitudes (See appendix 1 for the complete list of statements). The higher the score, the higher the association of a person with an eco-centric worldview. These statements encompass five dimensions of environmental concern (Dunlap et al., 2000):

- Limits to Growth: This dimension reflects beliefs about the Earth's finite resources and the potential consequences of exceeding those limits. It assesses individuals' agreement or disagreement with statements such as "We are approaching the limit of the number of people the Earth can support" or "The Earth has plenty of natural resources if we just learn how to develop them."
- Anti-Exemptionalism: This dimension measures the belief that humans are not exempt from the laws of nature nor that they can dominate and control the environment without consequences. In other words, it suggests that humans are not separate from nature or above its laws. Instead, it recognizes that humans are part of the natural world and are subject to the limitations and interdependencies that exist within it. Using agreement or disagreement with statements, such as "Humans were meant to rule over the rest of nature" or "Humans will eventually learn enough about how nature works to be able to control it."
- Anti-Anthropocentrism: Anthropocentrism is the belief that humans are the central or most important beings in the world, and that everything else exists primarily to serve human needs and desires. In contrast, Anti-Anthropocentrism challenges this perspective by acknowledging

that plants, animals, and ecosystems have their own inherent worth and should be respected and protected. It assesses agreement or disagreement with statements such as "Plants and animals have as much right as humans to exist" or "The balance of nature is very delicate, and easily upset."

- Fragility of Nature's balance: This dimension refers to the recognition that the natural balance and functioning of ecosystems can be easily disrupted or damaged by human activities. It reflects an understanding that human actions, such as pollution, habitat destruction, or resource exploitation, can have significant negative impacts on the delicate ecological balance of nature. It measures agreement or disagreement with statements such as "The balance of nature is strong enough to cope with the impacts of modern industrial nations" or "Humans have the right to modify the natural environment to suit their needs."
- Possibility of an Eco-crisis: This dimension reflects the perception that nature is delicate and vulnerable to human activities. It assesses agreement or disagreement with statements such as "The Earth is like a spaceship, with a limited number of resources and room" or "Humans have the right to modify the natural environment to suit their needs."

The original scale, released in 1978 is now 45 years old and even the revised scale, released in 2000, is now 23 years old – in our era of rapid technological advancements, this is a substantial amount of time. Nevertheless, in the decades since the original release of the NEP, many studies have been testing the applicability of the scale in various countries, sample sizes and settings and the results have been consistent. A meta-analysis of 63 studies and 36 countries found that 139 sample type did not have an effect on the score(Hawcroft & Milfont, 2009). In another comparative study testing the same sample from 1997 and again in 2012, showed that not only that the NEP continues to be accepted, but its "structure and coherence… are highly consistent over time" (Xiao & Buhrmann, 2017). Research has shown that individuals who score higher on the NEP scale tend to hold more pro-environmental attitudes and are more likely to engage in pro-environmental behaviours. They are more likely to support environmental policies, conservation efforts, and sustainable practices. They also tend to exhibit greater awareness of environmental issues and express a sense of responsibility towards the environment and future generations (Mayer & Frantz, 2004).

However, it is important to note that the NEP has its limitations. It is a subjective measure and a snapshot of individuals' attitudes and beliefs, taken at a single point in time. Although the NEP can predict pro-environmental behaviour, its main use is to measure awareness and "core attitudes and beliefs" (Dunlap et al., 2000) that may not always align with behaviours. Additionally, the NEP does not capture the full complexity of individuals' relationships with the environment, including cultural, social, economic, and psychological factors that can influence environmental attitudes and behaviours over time (Stern et al., 1995, 1999). Moreover, NEP doesn't reflect an individual's experience with nature, but instead is measuring knowledge-based, cognitive beliefs. In other words, the scale is not tailored to personal relations with nature but a generalist worldview (Mayer & Frantz, 2004).

2.2.2 Theory of Planned Behaviour (TBP)

The TPB model (see Figure 2) explains that behavioural intentions are the most immediate predecessors of behaviour, which in turn are determined by three key factors: attitudes, subjective norms, and perceived behavioural control. (1) **Attitudes** reflect the individual's positive or negative evaluations of the behavioural option in question. For example, does an individual perceive gardening as a positive or a negative experience. (2) **Subjective norms** capture the perceived social pressure from reference groups, these can be family, friends, neighbours and coworkers, to engage or not engage in the behaviour. For example, if most of the gardens in the neighbourhood are green, or how neat they are kept, will create a social norm that others will try to adhere to. (3) **Perceived behavioural**

control relates to an individual's perceived ability to execute the behaviour with ease or difficulty. It is based on beliefs about the resources, opportunities, and constraints available to them.

The intention is the closest relationship, but doesn't guarantee an actual behaviour. A more favourable attitude, stronger subjective norm, and higher perceived behavioural control should increase the individual's intention to undertake the behaviour (Ajzen, 1991).

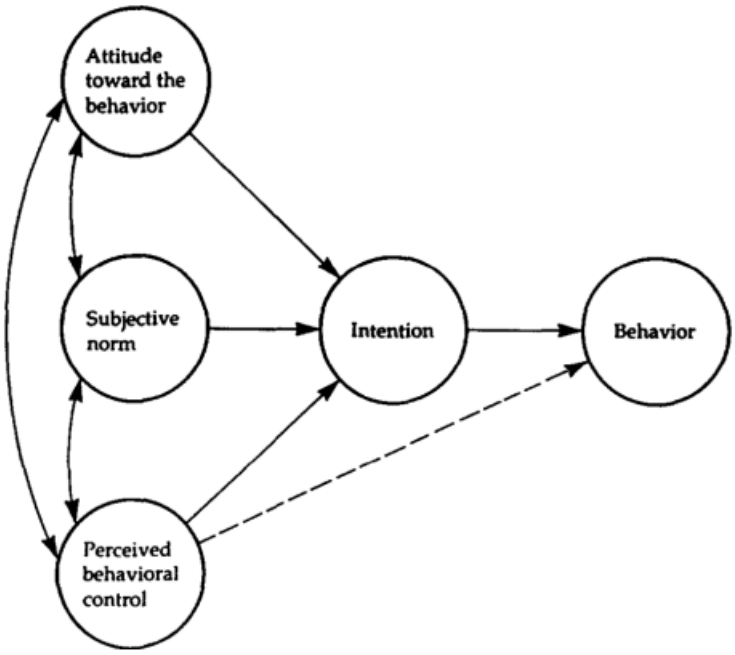


Figure 2 The model of "Theory of Planned Behavior". Attitude, norms and perceived control are a strong precursor to driving intention. The stronger a person's intention to perform a behavior, the more likely they are to perform that behavior.
Source: (Ajzen, 1991)

2.3 Contextual Interaction Theory (CIT)

To answer the research questions, the Contextual Interaction Theory (CIT) is used as a basis for the theoretical framework to understand how homeowners' behaviours and attitudes are influenced by the societal context in which they are embedded. In its origin, the theory was developed to analyse the implementation success of policies. Bressers et al. suggested that instead of focusing on the content of the policy itself, the processes that are shaping the involved actors, are a better way to understand the success rate of implementation (Bressers et al., 2000). As the name of the theory suggests, each of the actors involved, being individuals or organizations, are influenced by varying levels of societal contexts, which further shape their behaviours and attitudes.

The theory defines two areas of focus, the "process interactions" and the "Contextual layers", see Figure 3. The first dives deeper into the characteristics that define each actor and on the interaction between actors. The latter, defines three contextual layers, that each of them separately, can co-influence the interaction processes of the actors.

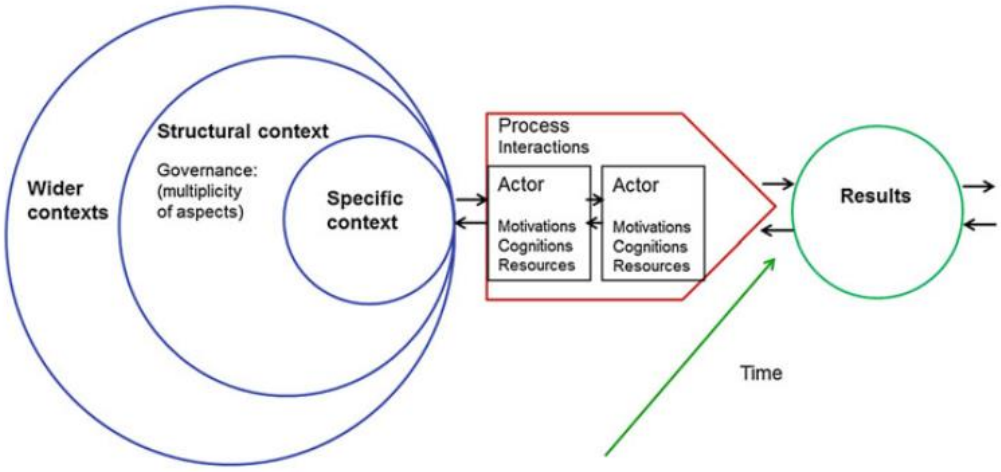


Figure 3: Dynamic interaction between the key actor-characteristics that drive social-interaction processes which are in turn reshaped by different layers of context. Source: (H. Bressers et al., 2016)

Each individuals' behaviours and actions are driven by three characteristics: their motivations, cognition and resources. **Motivations**, according to Bressers et al (2016) can be either internal or external. Self-interest, altruistic values and the personal perceived control over the outcome ("self-effectiveness assessment") are internal. While societal norms and regulations act as external motivations. In the case of this research question, understanding what influences homeowners' decisions to adopt green infrastructure measures will include factors of social norms and values related to nature and the environment. **Cognitions** are "interpretation of realities held to be true" (H. Bressers et al., 2016) whereby it's not only the knowledge and ability to process it that is important, but also how this information is understood and perceived by the actor. Influences by external events and other actors can act as "filters" of reality which can bias the understanding. In their theory of *Advocacy Coalition Framework*, researchers Sabatier and Jenkins-Smith adds to this notion by describing actors involved in the policy process as "boundly rational". Meaning, actors are steered by beliefs and are limited cognitively by the amount of information, sequencing of information and problems (Sabatier & Jenkins-Smith, 1999; Weible et al., 2009). **Resources** are important to drive action and can also be a source of power. Which in its turn, can provide more resources, therefore indicating a positive relationship (H. Bressers et al., 2016).

All three actor characteristics are dependant on and influencing each other. There is a relationship between Motivation and Resources. An actor that doesn't have resources, will have a low self-efficacy assessment that will de-motivate him to act. Vice versa, perceiving a task as out of personal control will negatively affects one's will to act. Cognition and Motivation are also mutually influenced. Motivation is needed to seek knowledge but also knowledge awakens motivation to seek more knowledge. The famous "power is knowledge" phrase fits perfectly in describing the relationship. As more knowledge could lead to power, hence, link to Resources (H. Bressers et al., 2016).

The **contextual layers** are the specific context (e.g. geographical location), the structural context (e.g. governance regime) and the wider context (e.g. politics, cultural and economics), which mutually shape and are being re-shaped by the process interactions of the actors (H. Bressers et al., 2016). This thesis will focus on the process interactions, more specifically on the motivations, cognitions and resources and therefore will not elaborate on the contextual layers. Nevertheless, they are recognized to contain valuable information that could affect the behaviour and will be therefore the "specific context" layer will be a part of the conceptual framework.

3 Conceptual framework and hypotheses

In this chapter, the theories explained in Chapter 2.2 and 2.3 will be operationalized into a conceptual framework that will serve as the foundation for the data collection phase and interpretation of the data. The Contextual Interaction Theory (CIT), the New Ecological Paradigm (NEP) and the Theory of planned behaviour (TPB) will be combined to form the conceptual framework (see Figure 4). The CIT will be used as the backbone while certain elements will be borrowed from the NEP and TPB. The NEP will provide a practical tool for measurements of one's attitudes and beliefs, while the TPB will add elements that explain the behaviour. The additions and the re-grouping of elements will be described in the following paragraphs.

The CIT has been successfully used to test the efficacy of environmental policies in the past, making it the most suitable to the topic of this thesis – ultimately assessing the efficacy of climate change mitigation and adaptation policies of the city of Leeuwarden. The subcategories of the actor interaction processes described in Chapter 2.3 align well with other social theories while offering, to an extent, more flexibility in their definitions. The "motivations" subcategory pertains to the factors that influence decision-making, including values and beliefs. However, CIT doesn't provide tools to measure these factors. Therefore, it would be useful to include worldviews as part of the motivation category. Worldviews are closely related to values and beliefs, and in addition, the NEP offers a unique scale that can measure a person's eco-centric worldview in a practical way. The use of the NEP will also allow to measure certain aspects of the "cognition" subcategory since cognitions and motivations are closely related. But also, since some of the statements in the NEP can be either considered values or knowledge. For example, statement number 10 in the NEP (See appendix 6.2) reads: "The so-called 'ecological crisis' facing humankind has been greatly exaggerated." Providing a score on this statement requires the respondent to know that there is an ecological crisis ("cognition") but also indicate certain value to show compassion to this crisis ("attitude"). It has also been shown that environmental awareness includes elements of knowledge but also values and attitudes (Despotović et al., 2021). CIT also adds another benefit in a way that the actor's characteristics provide clear categories to explain the reasoning of the individuals with regards to their behaviour.

Social demographics, as part of the specific contextual layer are also included in the framework. Factors such as the level of education, monthly household income, age and ethnic background, have been used to explain differences in choices towards green infrastructure (GI) (see chapter 2.1.3.). Beyond demographic parameters, some questions about socio-cultural cues are included. Questions that ask if a tiled garden is perceived as neat tests strict aesthetic norms. Or, as found in a study in Rotterdam, whether ethnic background can have influence on choice of garden (Derkzen et al., 2016). Structural context and the Wide context are outside the scope of this research and will not be further analysed. Firstly, since the focus lies on understanding personal motivation factors and secondly, since it is assumed that the governmental structure and organization itself are positively supporting adaptation measures of the citizens.

CIT defines the "interaction processes" as a multiple actor arena, meaning that this model is relevant to many actors at the same time, all mutually influencing each other and the system they are in. In this conceptual model, two actors are chosen as most relevant for the study. Actor 1 will be defined as the residents of Leeuwarden living in house with a garden. Actor 2 will be defined as governmental officials representing the Municipality of Leeuwarden.

Lastly, inspired by the TPB, the original element of "Results" in the CIT are split into two for added nuance: "Willingness to act" and "Act". According to the TPB model, attitude is the most important driver of behavioural intention, which consequently is identified as a central factor in determining behaviour. Intentions are fed by indicative predictors, which in this thesis will be described as the 3 subcategories of motivation, resources and cognitions. The stronger the relationship between these factors the higher the chance of the behaviour to occur (Ajzen, 1991). Nevertheless, as Azjen himself notes his article, and many others in their criticism of the TPB (Armitage & Conner, 2001), intention does not always lead to actual behaviour but is "still an effective measure" (Greaves et al., 2013). This assumption was the basis of the hypothesis and is considered in the design of the questionnaire.

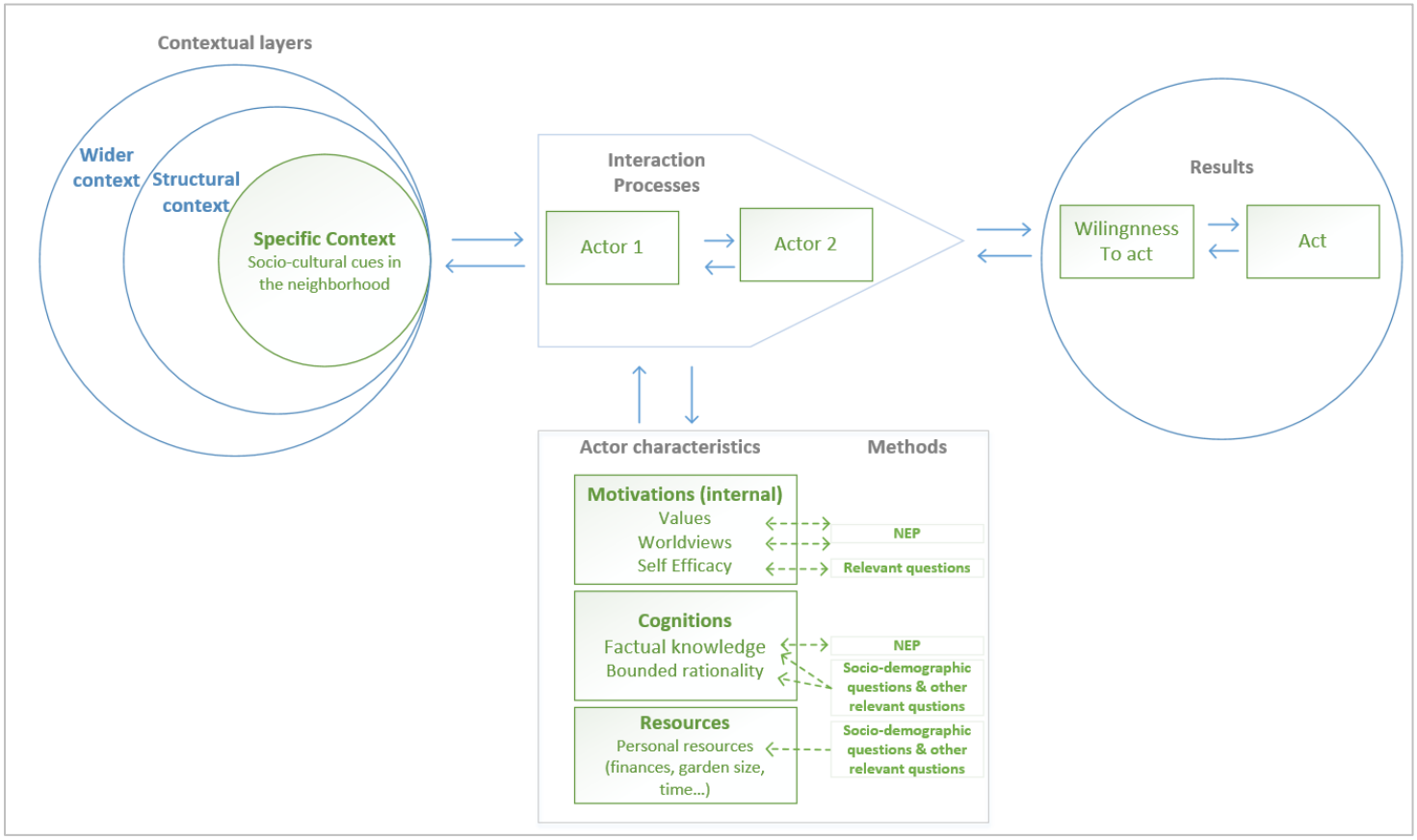


Figure 4: Conceptual framework that combines elements from theories: CIT, NEP and TPB. Elements coloured in green are included in the scope of this thesis.

Neither the NEP nor the TPB, claim a causal reaction between worldviews and action. However, as described in previous chapters, there are empirical studies that show that both demonstrate a strong association between values, attitude and worldviews and eventual pro-environmental behaviour. Therefore, in accordance with these models and adding the theory behind the CIT, the following hypotheses are made:

- *Hypothesis H1 - People who score higher on the NEP scale will have a higher willingness to have a green garden in their home.*
  (Testing: Worldviews → Willingness)
- Hypothesis H2 - Worldviews *alone are not sufficient to have a*n *actual green garden since other factors can influence the final outcome.*
  (Testing: Worldviews → Action)

4 Research Design and Methods

4.1 Study area

Friesland is a province in the north of the Netherlands that includes both urban and rural landscapes. The province has several larger cities, such as Leeuwarden, Drachten, and Sneek, as well as many smaller towns and villages. These urban areas are generally concentrated in the southern part of the province, while the northern and western parts are more rural, with a strong agricultural sector and a high degree of natural landscape.

Figure 5 Left: The location of the Province Friesland, the territory of the municipality of Leeuwarden is in red and the area of the city Leeuwarden is dark red. Right: the city of Leeuwarden. Source: Wikipedia.

Leeuwarden is the capital city of the province of Friesland, with a population of 94,650 citizens (CBS, 2021). The city is surrounded by rural areas that are characterized by agriculture and natural landscapes (see Figure 5). As with many other cities in the Netherlands, the urban areas of Leeuwarden consist of a mix of commercial zones, low-density housing with private gardens, high rise flats and public green spaces arranged in a mosaic pattern (*Woonplaats Leeuwarden in Cijfers En Grafieken*, n.d.).

According to the European Environmental agency, the total green infrastructure of the core city is 17%, comprising of: urban green space, trees, natural and semi-natural, sport and leisure, private gardens, allotments and High Nature Value Farms. This is considerably lower than other Dutch cities in the database (European Environment Agency, 2018b). Tree coverage, in both public and private lands amounts to 9.3%, which is ranked at place 38 out of 47 cities in the dataset (European Environment Agency, 2018c). In 2021, approximately 60% of the gardens in the municipality of Leeuwarden (which includes the greater area combining the city and surrounding villages) contained 50% or more greenery. This implies that the remaining 40% of gardens in the municipality of Leeuwarden are predominantly paved areas (Gemeente Leeuwarden, 2021).

4.2 Data sources

To address Research Question 1, the methodology involved conducting a comprehensive literature review focused on social theories of behaviour. The aim was to identify and examine the

relevant factors, partly arising from social theories, that have the potential to influence citizens' engagement in pro-environmental behaviour, specifically related to green gardens. Demographic parameters were also added to the survey to investigate their influence as possible factors. In addition, desk research on the concept of NbS and its definition was relevant. The sources of data included Scopus, grey literature and government documents.

For RQ 2, the methodology included the analysis of the survey results. The survey questions were designed to provide insights about the three "actor characteristics", namely, Resources, Cognition and Motivations. Motivations were measured using the NEP scale and compared to actual actions taken by the citizens to test the relationship between pro-environmental attitude and green gardens.

For RQ 3, the methodology included qualitative interview with an expert from the municipality to gain a comprehensive understanding of the issue and analysis of the survey results.

Table 1 Data collection and sources Framework based on each research question

Research question	Required data	Data collection method	Sources of data
RQ.1 Does an ecological worldview influence homeowners' willingness to engage in NbS (green gardens) in their private residence? • **H1 -** *People who score higher on the NEP scale will have a higher willingness to have a green garden in their home.*	Literature about NEP and other related Psycho-social theories Literature about defining parameters for NbS Data about their worldview and their willingness. Willingness is assess also using questions on preferences and habits.	Literature review; Survey	Scopus; Google Scholar; gray literature
RQ.2 Does willingness lead to achieving NbS in the private residence? Which other factors drive action? • **H2** – *Worldviews alone are not sufficient to have a*n *actual green garden since other factors can influence the outcome.*	Actual behaviour of the citizens to compare willingness with action.	Data analysis of the Quantitative surveys from citizens	Literature review Surveys
RQ.3 What strategies can be employed to effectively promote and implement greener gardens in the context of Leeuwarden?	Data about policy preferences from citizens and feasibility check from experts.	Survey; Interviews	Interviews with key stakeholders (municipality representatives) Survey results

4.3 Data collection

A thirteen-page survey was employed to adopt an explorative research approach, aiming to understand citizens' personal opinions and motivations in selecting private garden designs. The findings were obtained through an internet questionnaire survey, which was made accessible in both digital and hard copy formats. This approach aimed to ensure inclusivity by accommodating individuals who lacked internet connectivity or possessed limited proficiency in using online platforms. By offering a paper-based option, individuals without internet access or those who faced challenges with online navigation were still able to participate in the survey. This approach aimed to maximize the representation of diverse respondents and promote inclusivity in the study.

Data collection took place from June 12th to June 25th, 2023. Both digital and physical surveys were distributed to participants. Digital channels such as WhatsApp, LinkedIn, Facebook groups, and a community activities application in the Leeuwarden area were utilized. In addition, physical distribution involved survey flyers containing a QR code for web-based access, which were placed in public spaces across the city, including the library, supermarkets, stores, and the 'Groene Ster' recreation area. Furthermore, the researcher personally distributed the survey flyers on multiple occasions. This method allowed for increased participant responsiveness, as individuals had the opportunity to ask questions and engage with the researcher. Specifically, the researcher distributed the flyers during a sustainability-themed activity organized by the municipality in the West-Huizum neighbourhood on June 16th, 2023. The following day, on June 17th, 2023, residents in the city-centre were approached individually and given a flyer. Additionally, a door-to-door distribution technique was employed, with flyers being randomly distributed to houses in different neighbourhoods throughout Leeuwarden. Whenever possible, the researcher engaged with residents personally on the streets of their respective neighbourhoods before handing out the flyers.

The sample included participants 18 years and older, with the prerequisite that they are residents of Leeuwarden and that they live in a house with a garden. The questionnaire was distributed both in Dutch and in English. Participant selection aimed to include representatives from various population groups, considering factors such as gender, age, and ethnical background. The focus on specific neighbourhoods was driven by the diversity in housing types, including predominantly owned or rented properties, as well as a mix of both.

4.4 Survey Design and Analysis

Based on literature and the developed conceptual framework it is assumed that beliefs, motivation and attitudes lead to willingness which, in turn, is expected to lead to action. This can be represented with the following causal chain: beliefs (measured by NEP) → Willingness → Action. The first relationship arrow reflects H1, and the second arrow reflects H2. Background and build-up of the hypothesises is further explained in chapter 3. The three elements of the hypothesises, namely NEP, Willingness and Action, were each a section in the survey, followed by a 4th section regarding preferred policies, which was added to provide more insights for answering the 3rd research question.

The survey contained a total of 21 questions, separated into five sections. The first part contained general demographic questions. The next was based on the theory from NEP, with the goal to identify the respondent's relationship with nature based on their beliefs. Section three provided questions on the willingness of the respondents to engage with nature and about their willingness to have a green and biodiverse garden. Section five tested the actual state of their garden, which was representative of their "action". Lastly, two questions asked about possible policies to support citizens in transforming their gardens.

The sections below describe the rationale behind the design of each section in the questionnaire, its operationalization, and the analysis of the results. The full questionnaire can be found in Appendix 9.2.

4.4.1 Demographics section

As described in chapter 2.1.3, demographics have shown to have an influence on the design choices of private gardens. Eight questions covered basic demographic parameters of the respondents. These were, area of residence, ownership type of the house, sex, age, educational level, annual household income and ethnic background.

4.4.1.1 Demographic analysis

The analysis was done using the Stats iQ function in Qualtrics website, which choses the most suitable statistical test for each analysis based on the type of data and size of the sample.

4.4.2 Worldviews section

Using H1 as guidance, the relationship between two elements is important: (A) defining an individuals' worldview and (B) the willingness to apply NbS. This section was devoted to determining the respondents' worldviews according to the NEP theory. From the literature it is assumed that NEP has high correlation with appliance of NbS. However, according to the TPB theory, an additional step is added in the form of willingness. Therefore, the scores of the respondents from this section were used to evaluate if ones' worldview indeed matches with their willingness to have the actual behaviour.

The respondents were asked to answer a set of 15 statements based on the revised NEP scale (Dunlap et al., 2000). They received the following question: "Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you (mainly) agree, unsure, (mainly) disagree". This is deviating from the original design of the scale which used a five-point Likert scoring scale but was done so to ease the questionnaire answering process. This is not expected to alter the efficacy of the scale, since only the scoring was changed but not the number of statements (Hawcroft & Milfont, 2009). The wording of the statements closely resembled the original ones, with some slight simplifications made in statement number 4, replacing "Human ingenuity will ensure that we do NOT make the earth unliveable" with "Human creativity will ensure

we keep the Earth liveable". Additionally, since the survey was also translated into Dutch, there may have been some alterations in the wording.

4.4.2.1 Worldviews Analysis

The respondents were scored on each statement using a score between 0-3. Odd-numbered statements have a standard scoring scale, while even-numbered statements have a reversed score-scale. Based on the total score of the respondents (ranging from 0 to 30 points) using an ordinal scale, their worldviews were categorized on a spectrum from "Extremely Anthropocentric" to "Strongly Eco-centric" denoted as "Wv $^{A-E}$". Wv^{A} represents “strongly Eco-centric”, while Wv^{E} signifies “Extremely Anthropocentric”. See Table 2 for the scoring per statement and Table 3 for the categorization of the worldviews based on the score of the NEP statements.

To enhance the analysis, the statements were additionally categorized into five dimensions: Economic growth, Eco-crisis, Natural conservation, and Human exceptionalism. This division allowed for a more comprehensive understanding of the specific elements that make up the environmental worldviews of the respondents. The total score “Wv^{A-E}” and the dimensions were not visible to the respondent.

Table 2 Division of the NEP statements into five dimensions and their representative scoring per statement.

Dimensions of NEP	**Statements from NEP** (see appendix 1 for original order of the statements)	**(Mostly) Agree**	**Unsure**	**(Mostly) Disagree**
Limits of Growth	1. We are approaching the limit of the number of people the earth can support	2	0	1
	6. The earth has plenty of natural resources if we just learn how to develop them	1	0	2
	11. The earth is like a spaceship with very limited room and resources	2	0	1
Possibility of an Eco-crisis	5. Humans are severely abusing the environment	2	0	1
	10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	1	0	2
	15. If things continue on their present course, we will soon experience a major ecological catastrophe	1	0	2
The fragility of nature’s balance	3. When humans interfere with nature it often produces disastrous consequences	2	0	1
	8. The balance of nature is strong enough to cope with the impacts of modern industrial nations	1	0	2
	13. The balance of nature is very delicate and easily upset	2	0	1
Rejection of Human Exemptionalism	4. Human ingenuity will ensure that we keep the Earth liveable	1	0	2
	9. Despite our special abilities humans are still subject to the laws of nature	2	0	1
	14. Humans will eventually learn enough about how nature works to be able to control it	1	0	2

Anti-anthropocentrism	2. Humans have the right to modify the natural environment to suit their needs	1	0	2
	7. Plants and animals have as much rights as humans to exists	2	0	1
	12. Humans were meant to rule over the rest of nature	1	0	2

Table 3 Gradation of Environmental worldviews based on the total score of NEP statements. Uppercase letters in the summary row represent wv=worldviews.

Scores (points)	0-6 p	6-12p	12-18p	18-24p	24-30p
Categorization Worldviews (Wv)	**Wv^E.** Extremely Anthropocentric	**Wv^D.** Mildly Anthropocentric	**Wv^C.** Neutral	**Wv^B.** Mildly Eco-centric	**Wv^A.** Strongly Eco-centric

4.4.3 Willingness section

In order to define the willingness, the respondents were asked to answer a series of questions with both textual and visual methods.

The first three questions tested the respondent's appreciation to nature and its' processes. One of these questions tested preferences for the 'ideal' outside space using a visual question. By comparing different photos, the respondent could choose which one appeals most to him/her. Photo-language evokes emotion, imaginations, associations and can be clearer to understand in cases the respondent doesn't not have enough knowledge on the subject (Beumer, 2018; S. S. Smith, 2010; White et al., 2009). See Figure 6 for the pictures used. Other two questions examined habits and interests related to nature, asking the following questions: "How important is it for you to live close to a green environment?" and "Do you enjoy observing nature, indoors or outdoors?". These activities are important parameters to a "biophilic" city, which is a concept that assesses whether citizens possess knowledge and habits that correlate with a positive attitude towards nature in their urban environment (Beatley, 2011).

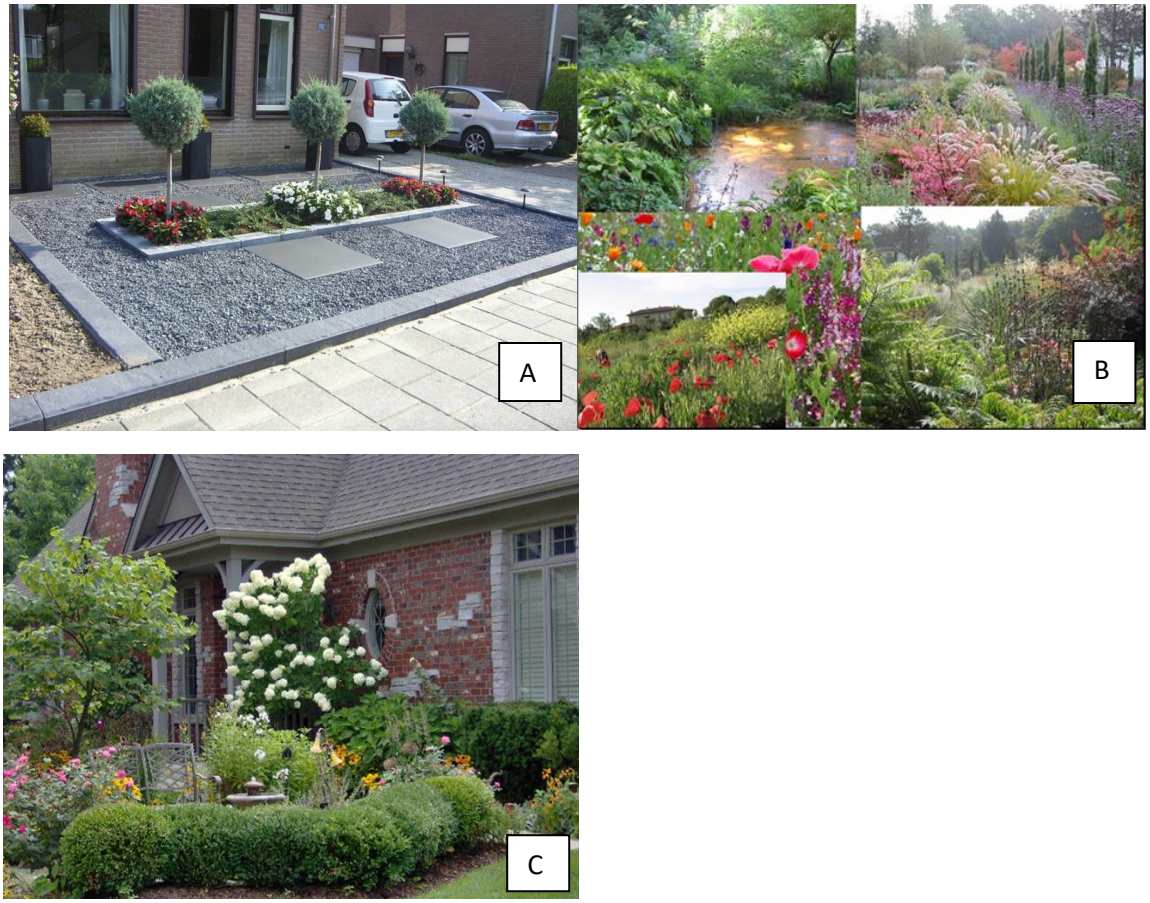


Figure 6: Photo-language used in the survey. Picture A: representing a modern style garden, characterized by low variance in plants, higher functionality and higher level of soil sealing (Source: TMG Grondwerken). Picture B: English Cottage style garden, characterized with medium-high plant variance, high water absorbing and low-medium native species variance. (Source: (Beumer, 2018) *). Picture C: Wild Garden, characterized by high variance of plants, predominantly with native species and high water-absorbance.*

Lastly, the respondents were asked to indicate their willingness to have a green garden by filling in a matrix with technical criteria representing different levels of a green garden. Biodiversity and rainwater absorbance are chosen as the most relevant criteria for climate change adaptation measures in private urban gardens. Rainwater absorbance was represented in (1) %area covered with plants and trees (Stichting Steenbreek, 2023). Biodiversity was measured by: (2) %variance in sorts of plants (trees, shrubs, low level plants such as flowers and herbs) (3) %native species. High variance of plants predominantly with native species play a crucial role in maintaining the health of local biodiversity. This is because native species have adapted to the specific hydrological conditions of the area and are more likely to attract local insects, unlike exotic plants (Mata et al., 2021) .

4.4.3.1 Willingness Analysis

Scoring for the questions relating to affiliation with nature were multiple-choice, scored according to an interval scale:

Question	**Scoring (points)**				
How important is it for you to live close to a green environment?	Extremely important (4)	Very important (3)	Moderately important (2)	Slightly important (1)	Not at all important (0)
How would you describe the activity of observing nature, indoors or outdoors? Think	I find it extremely		I find it somewhat		I don't find it enjoyable at all

for example about activities such as listening to birds or observing changes in plants' growth.	enjoyable (2)		enjoyable (1)		(0)
Which of the following pictures do you find the most attractive for a garden/outside space?	Modern garden (0)		English cottage garden (1)		Wild garden (2)

Each NbS criterion was assessed using an interval scale with scores ranging from 1 to 5. A score of 1 represented 0% and a score of 5 represented 100%. The scores for each criterion were then added together to calculate the total willingness (Wt) score for each respondent. Please refer to Table 4 below, which provides an example with the scores filled in.

Table 4 Analysis scheme for assessing the willingness of the respondent to have NbS in his garden.

Scale / **NbS Criteria ideal garden**	**0 % (1)**	**25% (2)**	**50% (3)**	**75% (4)**	**100% (5)**	**W_t**
1. Ideally, I would like to have __% of my garden covered with plants and/or trees		x				
2. I'm willing to increase the biodiversity in my garden by planting a big variety of plants (trees, shrubs and low-level plants such as flowers and herbs) Choose between 1 -5. 5 being high variance			x			
3. I'm willing to plant mainly native species to support local biodiversity. Choose between 1 -5.			x			
Sum	1	2	6			=9

The overall Willingness score was calculated by combining the scores of three questions related to affiliation with natural processes, along with the scores of the NbS criteria, which were then divided into categories ranging from $WtNbS^{A-E}$. See table 5 below for the division and the representative titles per category.

Table 5 Categories of Willingness to NbS (WtNbS) based on the total score of the section.

Scores	0-3	4-8	9-13	14-18	19-23
Categorization Willingness to have NbS (WtNbS)	**$WtNbS^{E}$.** Resistant	**$WtNbS^{D}$.** Indifferent	**$WtNbS^{C}$.** Neutral	**$WtNbS^{B}$.** Eco-Conscious	**$WtNbS^{A}$** Eco-system Guardian

Hypothesis H1 predicts that respondents who score Wv^{A} or Wv^{B} for their worldview questions will also score $WtNbS^{A}$ and $WtNbS^{B}$ for their willingness questions. However, there is a possibility of deviance from this hypothesis, indicating that worldviews do not align with willingness. To test H1, a separate analysis was conducted using Excel, examining the relationship between the scores of Wv^{A-E} and $WtNbS^{A-E}$ for each respondent. If the worldviews did indeed correspond to willingness, the hypothesis was marked as "true," otherwise it was marked as "false."

4.4.4 Action section

Similar to the previous section, this research question will use H2 as guidance for the questionnaire design. While H1 tests the relationship between values and willingness, the second hypothesis will test whether worldviews indeed translate into action and whether the gradation of the worldview has the expected influence on the end outcome. In case of discrepancies, namely that a despite a strong or modest ecological worldview an individual didn't apply NbS in reality, the factors that might contribute to that will be analysed, and categorized using the CIT.

At this phase, the values and the willingness have been assessed. The last step is to plot the actual state of the gardens of the respondents in a matrix. To maintain consistency, the same NbS criteria as in Table 4 will be used. However, this time the end-result will be represented with the score of Total Action (A_t), see Table 6 with a filled-in example. The results will be categorized according to Table 7.

Table 6 Analysis scheme for assessing the actual application of NbS in the respondents' garden.

Scale **NbS Criteria actual garden**	**0 % (1)**	**25% (2)**	**50% (3)**	**75% (4)**	**100% (5)**	**A_t**
1. __% of my garden is currently covered with plants and/or trees		x				
2. My garden has a big variety of plants (trees, shrubs, low level plants such as flowers and herbs) Choose between (1 - 5), 5 being high variance.		x				
3. My garden has mainly native species to support local biodiversity. Choose between (1 - 5).		x				
Sum	1	6				=7

4.4.4.1 Action Analysis

Results of A_t will be categorized according to the scale in Table 7. According to H2, it is assumed that respondents that received a high score on their worldviews will not necessarily apply NbS due to other contextual factors that may influence their willingness. Therefore, it is expected that there will be no correlation between scores of WtNbS and ActNbS. To test H2, a separate analysis using Excel will test, per respondent, the relationship between the scores of ActNbS and WtNbS. The result of the hypothesis was represented with either a 'true' or 'false'.

Table 7 Categories of Action to NbS (ActNbS). Uppercase letter represents a=Action

	0-4 p	5-8	9-12	13-16	17-20
Categorization Willingness to have NbS (ActNbS)	**ActNbS^{E}.** Resistant	**ActNbS^{D}.** Indifferent	**ActNbS^{C}.** Neutral	**ActNbS^{B}.** Eco-Conscious	**ActNbS^{A}.** Eco-system Guardian

After the respondents have provided answers to all three elements (NEP, Willingness and Action) a series of questions asked the respondents to explain their reasoning, using the following question: "What are the reasons that you chose for a garden with less than 50% plants? Please choose 4 answers" or "What are the reasons that you chose for a garden with 50% - 100% covered with plants? Please choose 4 answers". The respondents also had the opportunity to enter a free text response if none of the of the provided choices aligned with their perspective. In the next question, respondents were asked to rank their reasons. The resultant data underwent a distinct analysis employing the

conceptual framework rooted in the CIT, with the findings subsequently summarized according to Table 9.

Table 8 Categorizing reasons for deviation from Hypothesis2 according to CIT

EWv → ActNsB	**Motivation**	**Cognition**	**Resources**
General reasoning	In general 1, 2, ...	In general 1, 2, ..	In general 1, 2, ..
Factors that specifically address NsB	As regards NsB 1, 2, ..	As regards NsB 1, 2, ..	As regards NsB 1, 2, ..
Factors that are not in row 1+2 which respondent can add	Other … (open)	Other … (open)	Other … (open)

4.4.5 Policy section

Research question 3 is aiming to find which strategies can be employed to effectively promote and implement greener gardens in the context of Leeuwarden. In order to provide insights, the last section contained two questioned that asked the respondents about their knowledge of available subsidies provided by the municipality of Leeuwarden, followed by a multiple-choice question that asked them to choose which policies might support them in greening their private gardens. An open question was available for additional input that was not already provided.

For the qualitative empirical research, semi-structured, open-ended questions interview was conducted with the representative from "Operatie Steenbreek" within the Municipality of Leeuwarden. The interview included questions about the municipality's approach to incentivize homeowners, the achievements, and challenges of the projects they faced so far, and the actual impact these interventions had on making Leeuwarden more climate adaptive. The goal of the interview was to provide additional inspiration to the conclusions, assist with finding more respondents for the survey and eventually confirm the results of the survey.

4.4.5.1 Analysis Action

The results from the multiple-question survey were analysed quantitatively, while the open answers were screened and summarized manually. Since only 2 interviews were conducted, the same technique was used for analysing the results of the interview.

5 Results

5.5 Survey

The dataset used in this study comprised of responses collected through an online survey, with the aim of investigating the factors influencing individuals' choices between green gardens and paved gardens. The results from the survey were collected using Qualtrics program and partially analysed using Qualtrics and Excel program. By examining the responses provided by the participants, patterns and trends are identified, shedding light on the key motivators behind these choices and assisting in answering the research questions. This chapter segregates the results of the survey analysis based on

the previously described sub-sections of the survey. For each section, the most relevant descriptive results are added as well as relevant statistical analysis examining relationship between variables.

5.5.1 Sample

The final sample contained 155 responses, out of which 26 respondents did not fit the basic criteria to participate, meaning they needed to be older than 18 and live in Leeuwarden in a house with a garden (rented or owned). From the 127 questionnaires left, 117 were fully filled-in with valid responses. Ideally, the sample size would have been larger but nevertheless, data quality of the sample was satisfactory and sufficient for performing statistical tests using Qualitrics, which was also confirmed by the program. The questionnaires contained logically filled-in answers with minimum outliers, representing a relatively good ratio between female and male from different neighbourhoods of Leeuwarden.

5.5.1.1 Demographic profile of the sample

The following sub chapter provides the results of the demographic data of the final sample of 117 respondents.

The gender distribution was 44% male, 54% woman and 2% of the respondents identified themselves as other. In terms of age, there are two groups that were most dominant. Age group of 30-45 represented 43% of the sample and the age group of 46-67 was the second biggest group with 37%. The group of 68-70 represented 13% of the sample, while respondents younger than 30 represented 7%. Only one participant was older than 81. See Figure 7 (A) and (B).Figure 7

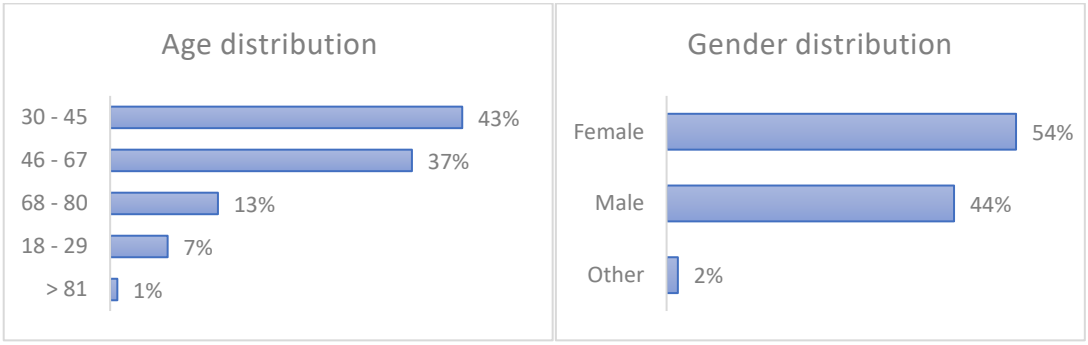


Figure 7 Left: Age distribution of the survey sample. Right: Gender distribution of the survey sample

The dataset included information on the respondents' educational attainment, with the purpose of examining the relationship between education and preferences for green gardens. Educational background was categorized into four main categories: University (WO), Higher vocational education or also known as University of Applied Science (HBO), Secondary Vocational education (MBO), and High school graduate (VMBO, HAVO, VWO). Roughly three quarters of the sample comprised of participants with a higher education, out of which, 43% acquired a higher vocational education (HBO). University education (WO) follows closely behind, with 29% of the participants having attained a university degree. Secondary Vocational education (MBO) represents 17% of the participants, while High school graduates (VMBO, HAVO, VWO) make up 6% of the sample. See Figure 8.

These findings suggest that individuals with higher levels of education, such as HBO and WO, may be more likely to participate in the survey or have a stronger interest sustainability topics.

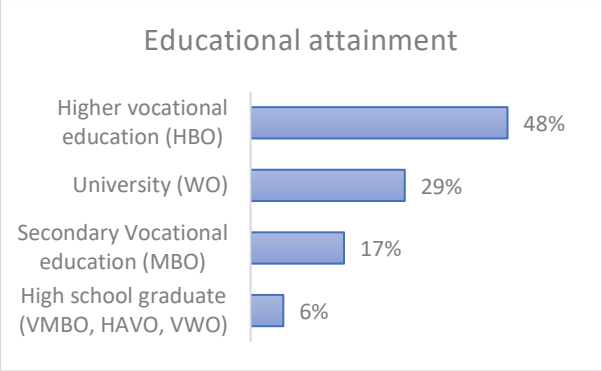


Figure 8 Distribution of educational level of the survey sample.

The results of the survey exhibited a varied income distribution among the participants, reflecting different financial backgrounds and levels of affluence. The largest proportion of participants falls within the income range of €20,000 - €39,999, accounting for 24% of the sample. Participants with incomes between €40,000 - €59,999 represent 23% of the sample, while those within €60,000 - €79,999 account for 16%. A smaller percentage of participants, 8%, have incomes falling within €80,000 - €99,999. Participants with incomes below €20,000 constitute 5% of the sample, while those with incomes above €100,000 and participants who prefer not to disclose their income make up 3% and 22%, respectively. The group that preferred not to disclose their income was not taken into account for the statistical analyses resulting in a decrease of the sample size from 117 to 91 participants. See Figure 9.

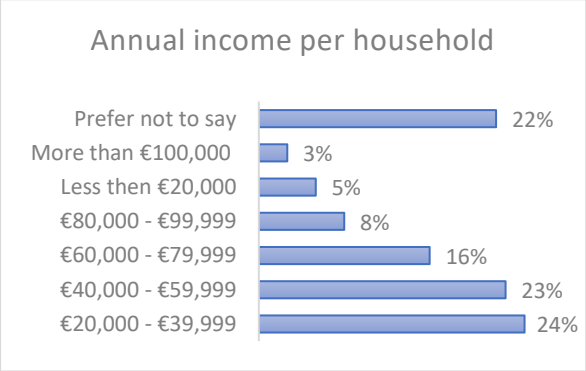


Figure 9 Sample distribution according to annual income per household.

The survey provided information on the respondents' place of birth, specifically whether they were born in the Netherlands or abroad. The majority of participants, 82%, reported being born in the Netherlands, with 78% of the participants reported having both parents born in the Netherlands, indicating a significant proportion of individuals from the native population. A small percentage of participants (3%) indicated having one parent born in the Netherlands and one parent born abroad, suggesting some level of multicultural background among a subset of the respondents. 18% of the participants consisted of individuals born abroad and therefore assumed to have a non-Dutch ethnical background. See Figure 10.

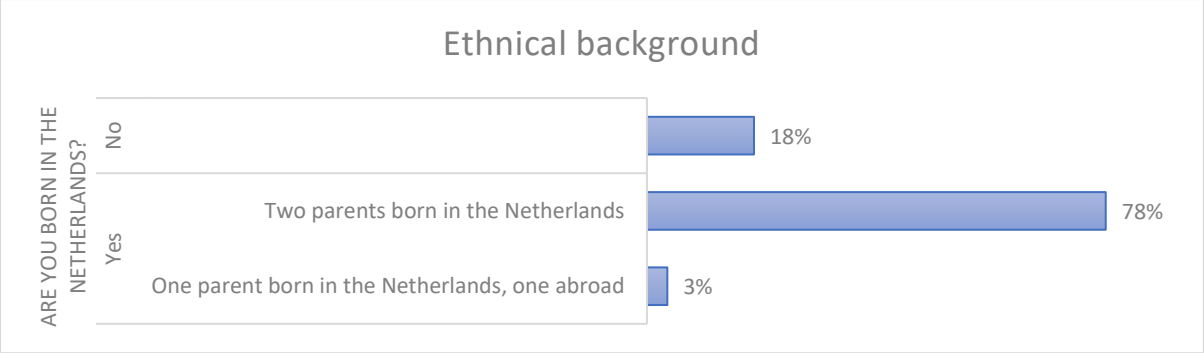


Figure 10 Sample distribution according to ethnical background.

Only residents of Leeuwarden living in houses with a garden were asked to fill in the questionnaire. In the first day that the questionnaire was released online, it was originally focused only on privately owned houses. However, due to previously mentioned relationship in the literature between ownership type and degree of garden vegetation, it was quickly changed to add also participants that reside in rented houses with a garden (no information regarding the renting type was acquired, i.e., from the private market or social housing organization). The results from the final sample show an 81,5% of respondents owning the house and 18,5% of respondents being renters.

In addition, postcode analysis from the results of the questionnaire was translated into a map to visualize the location of the respondents. As can be seen from Figure 11 there a high distribution covering different socio-demographic neighbourhoods.

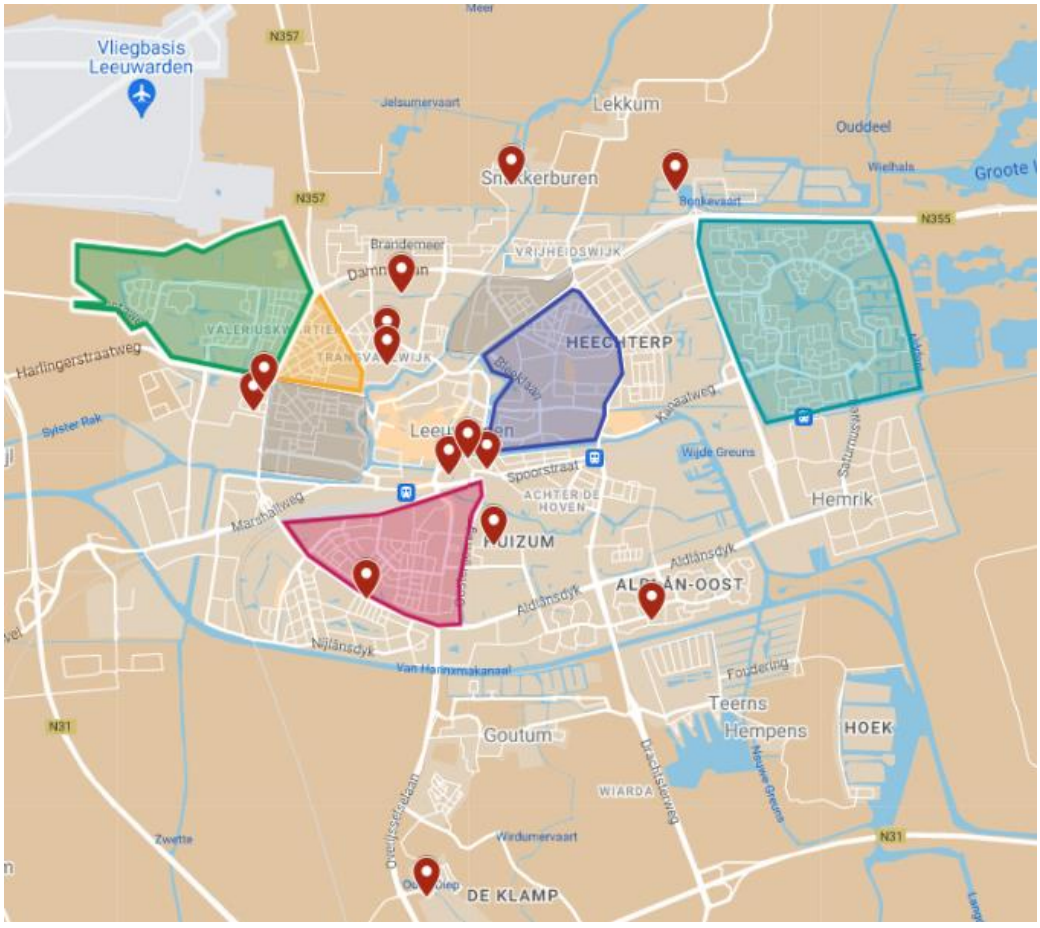


Figure 11 Visual representation of the respondent's residence place using postcode analysis.

5.5.2 Worldviews

Pro-environmental beliefs of the respondents were measured quantitively using the NEP (New Ecological Paradigm) scale, which assesses individuals' agreement or disagreement with statements related to ecological awareness and concerns. The responses were used to determine an individual's orientation, with higher scores indicating a more environmentally conscious worldview. The results were further separated into 5 categories, each representing a different level of environmental consciousness ranging from Extremely Anthropocentric (WvE) to Strongly Eco-centric (WvA).

5.5.2.1 Overall score

As can be seen in Figure 12, the combined percentages of participants falling within the "Mildly Eco-centric" and "Strongly Eco-centric" categories amount together to **79%** of the sample, revealing a substantial portion of participants to have environmentally oriented perspectives. The majority of participants, 62 individuals (representing 53% of the sample), fell within the "Mildly Eco-centric" category, indicating that most participants possess moderate, but nevertheless, ecological perspectives with an average sample score of 20.5 points.

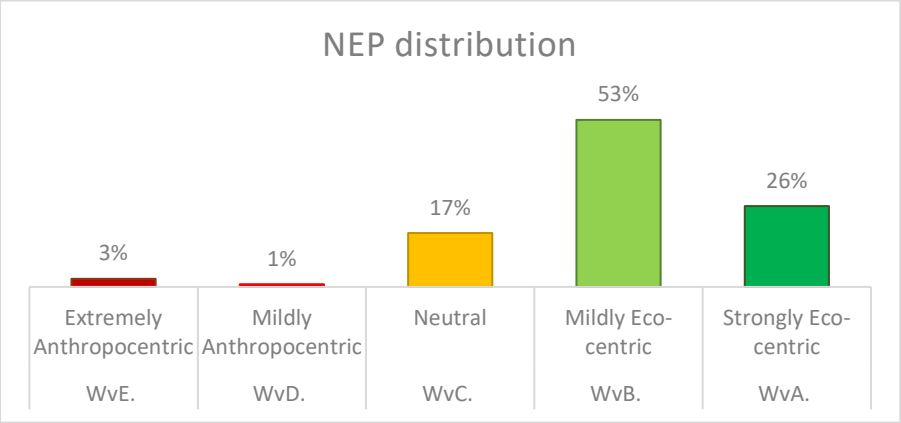


Figure 12 Analysis results of the sample's NEP scores. WvA-E stands for "Worldviews A-E" which was previously defined in section 4.4.2.

Descriptive statistics of NEP score:

Sample Size	Median	Average	Confidence Interval of Average	Standard Deviation	Minimum	Maximum
116	21	20,5	19,70 to 21,35	4,5	2	29

The 15 statements of the NEP were further separated into five dimensions providing a more nuanced view into people's perspective regarding their view on the relationship between humans and the natural world. The five dimensions were: Limits of growth, Possibility of an Eco crisis, Importance of natural conservation, Human Exemptionalism and Anti-anthropocentrism. The assessment of the separate dimensions provides valuable information which can inform the development of effective environmental policies, educational initiatives, and conservation strategies.

The dimension that received the highest score within the sample was "Fragility of nature's balance". It is evident that the sample group perceives nature as vulnerable and in need of protection. It reflects an understanding that human actions, such as pollution, habitat destruction, or resource exploitation, can have significant negative impacts on the delicate ecological balance of nature. This dimension comprised of 3 statements (3,8,13). 65% of the sample said they (mostly) agree that human interference with nature often produces disastrous consequences. 71% don't think that "The balance

of nature is strong enough to cope with the impacts of modern industrial nations" and 69% agrees that the balance of nature is "very delicate and easily upset".

The next dimension that followed closely was "Limits to Growth". This dimension reflects the recognition that there are inherent limits to economic growth and resource consumption. It acknowledges that the Earth's resources are finite and that exceeding these limits can have detrimental consequences for both the environment and human societies.

Among all participants, two statements received the highest consensus. In the dimension of "Rejection of Human Exceptionalism," statement 9, which states "Despite our special abilities, humans are still subject to the laws of nature," received an 88% agreement rate. Additionally, in the dimension of "Possibility of an Eco-crisis," statement 5, which asserts that "Humans are severely abusing the environment," received an agreement from 86% of respondents. These high agreement rates indicate a widespread endorsement that humans are not exempt from the laws of nature and that there is significant environmental abuse occurring.

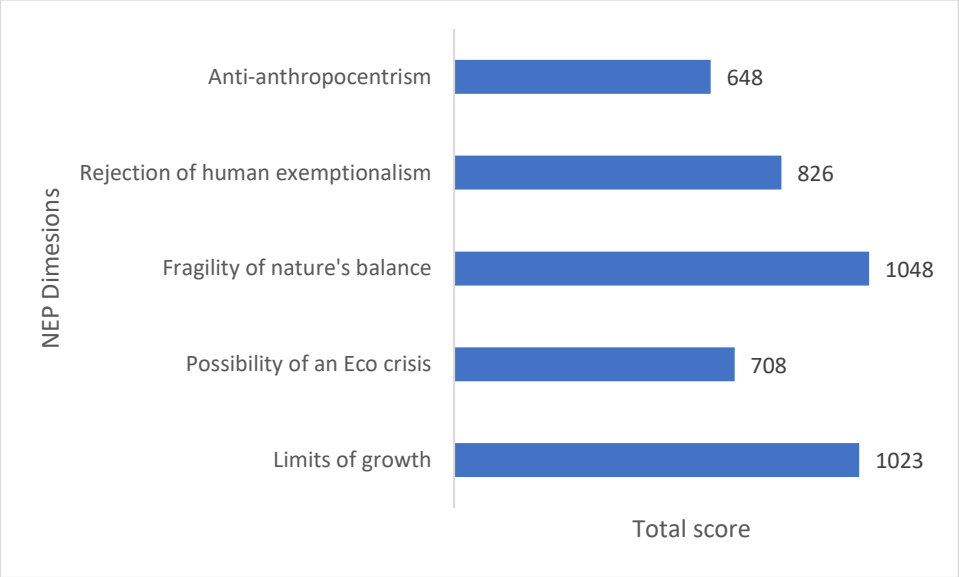


Figure 13 Sample distribution of the NEP dimensions

5.5.2.2 Statistical relationships

The results were also tested against the demographic variables to see whether they would influence a person's NEP score. However, neither of the demographic parameters demonstrated a statistically significant relationship with the total NEP score per respondent at the 5% significance level (P-value < 0.05). A value less than 0.05 means that a difference is "statistically significant" and therefore, it is consistent enough that it is unlikely to be a coincidence. The results of the tested variables are shown in Table 9:

Table 9 Results statistical analysis of all demographic parameters.

	Bruto annual household income	educational level	gender	Age	Ethnical Background
P-Value	0,157	0,665	0,131	0,453	0,123
Effect Size (Cohen's f)	0,366	0,127		0,157	
Effect Size (Cohen's d)			0,288		

Effect Size (Spearman's rho)					-0,144
Test type	Ranked ANOVA	Ranked ANOVA	Ranked T-Test	Ranked ANOVA	Ranked Correlation
Conclusion	No statistical significance	No statistical significance	No statistical significance	No statistical significance	No statistical significance

These findings do not match previous studies that found that a high NEP score was mainly endorsed by young, highly educated individuals (Dunlap et al., 2000; Hawcroft & Milfont, 2009). In this study neither age nor education were found to strongly influence the score.

5.5.3 Willingness

5.5.3.1 Overall score

The intension to have a green garden was represented by 'Willingness'. Participants were asked to answer 4 questions, 3 questions asked about their general interactions with nature and 1 matrix question assessed their 'ideal' garden based on three parameters, namely percent of plants, variety of plants and percentage of native species. The score distribution among the sample is presented in Figure 14. Almost the entire group showed willingness to have a green and sustainable garden, with the combined percentages of participants falling within the "Eco-Conscious" and "Eco-system Guardian" categories amount to 95%. Interestingly, there were no participants categorized as "Resistant" or "Indifferent". The average score of the group was 18, belonging to the category of "Eco-conscious".

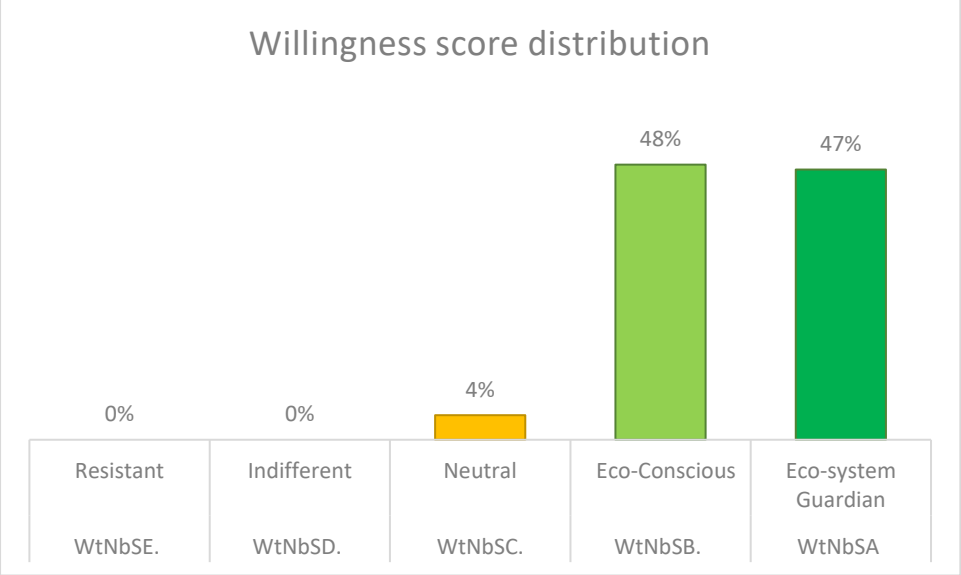


Figure 14 Sample distribution of Willingness scores

Sample Size	Median	Average	Confidence Interval of Average	Standard Deviation	Minimum	Maximum
116	18	18,0	17,49 to 18,55	2,9	10	23

From the three questions on the general experiences from interacting with nature, there was a very clear type of garden people find attractive. 69% chose for the "**Wild Garden**", and 28% chose for the "English cottage garden". This is interesting, since the cottage style garden is far more popular in reality and can be easily found in numerous houses across the Netherlands, while very few houses will design their garden as "wild". There is a clear dissonance between what is seen as beautiful or attractive and real-life choices. This question was inspired by much larger research conducted by C. Beumer where in one of the provided questions, people were asked to choose between 8 different distinct types of gardens. Yet the results were similar in ranking, with the wild garden chosen first and followed by the English cottage style (Beumer, 2018). The results of this current research show that only 3% chose the "modern garden" as their preferred style.

5.5.3.2 Statistical relationships

When testing for the influence of demographic variables on the willingness score, the parameter of "**educational level**" was found to be statistically significant with relation to willingness. Meaning that the higher the obtained education level, the higher the willingness to have a green and sustainable garden. Average scores of each group increased as educational level increases. This finding was confirmed also using a regression model to predict the results of Willingness based on the educational level. When setting Secondary Vocational education (MBO) as the basis, the willingness score increases 1,4 points for Higher Vocational education (HBO) and with 2,3 points for university graduates (WO). Moreover, both HBO and WO are statistically significantly different from MBO (P-value = 0,00740 and 0,00127 respectively).

Another interesting finding was that **gender** can also influence one's willingness score. Using a T-test, it was possible to evaluate whether the means of group 1 (females) tends to have a higher score than group 2 (males). And indeed, females tend to have higher values for willingness than males, with a statistical significance with a P-value of 0,046. Table 10provides further details on the results these tests.

None of the other parameters were found to be statistically significant.

Table 10 Results statistical analysis between demographic factors and willingness score. Cells in green highlight results with statistical significance.

	Educational level	Gender	Income	Ethnical Background	Age	Ownership type
P-Value	0,0251	0,046	0,146	0,353	0,901	0,810
Effect Size (Cohen's f[1])	0,357		0,320		0,0819	
Effect Size (Cohen's d[2])		0,387				0,0622
Effect Size (Spearman's rho)				0,0867		
Type test	ANOVA	T-Test	ANOVA	Ranked	ANOVA	T-test

[1] Cohen's f is an effect size measure used in the context of analysis of variance (ANOVA) to quantify the magnitude of the difference between groups.

[2] Cohen's d is an effect size measure commonly used in the context of comparing the means of two groups.

Conclusion	Statistical Significance	Statistical Significance	No Statistical Significance	No Statistical Significance	No Statistical Significance	No Statistical Significance

5.5.4 Hypothesis 1 – NEP vs Willingness

Hypothesis number 1 was first defined in the conceptual framework, and it assumes that people who score higher on the NEP (New ecological paradigm) scale will have a higher willingness to have a green garden in their home.

To test this hypothesis two separate tests were used for confirmation purposes. The first compared how often this relationship was correct by comparing each respondents' NEP score to his/her/its corresponding willingness score. More specifically, if a respondent scored a WvA or WvB in the NEP and scored a WtA or WtB for Willingness, then the hypothesis would be correct and market with a '1'. If this relationship was not met because, for example, willingness score was WtD or WtE, the hypothesis was marked with a '0'. Then, the percentages of true of false hypothesis was calculated. The result of this analysis in excel showed that H1 was true for 77% of the sample.

The second test used statistical method to test the relationship between Worldviews and Willingness. Using a Ranked Correlation test, it was found that NEP scores were was positively correlated with Willingness scores with a statistical significance of P-Value of 0.0107. Meaning that **the higher the obtained NEP score, the higher the willingness to have a green and sustainable garden**. The results are visually represented in Figure 15.

P-Value	0,0107
Effect Size (Spearman's rho)	0,236

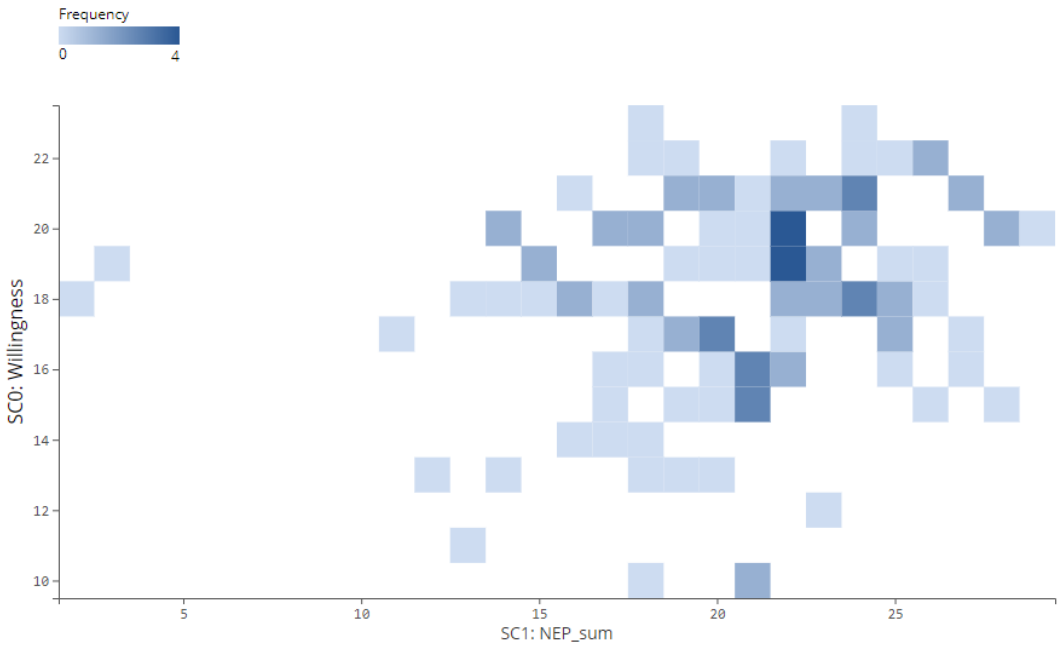


Figure 15 Results of testing Hypothesis 1 by plotting Willingness and NEP scores for statistical significance.

5.5.5 Action

The actual state of the respondents' gardens was calculated using the same matrix that was used to test the willingness. Respondents were asked to rate their garden using three parameters, namely percent of plants, variety of plants and percentage of native species. The main parameter of

importance was the percentage of plant coverage on their garden, which was used as a trigger for the following question: "what is the reason that you garden has more/less than 50% plants?". Respondents were prompted to select the reasons that were most relevant to them and rank them in order of importance including an open text field to provide any additional explanations if desired.

5.5.5.1 Overall score

The categories distribution showed that 47% of the sample would have a "Neutral" garden in term of sustainability. Whereas in willingness not even one person scored "Resistant" or "Indifferent", in the Action score, these categories represented 4% and 32% of the sample respectively. Similarly, the category of "Eco-system Guardian" represented 0% of the sample. The comparison between Willingness and Action scores can be found in Figure 16**Error! Reference source not found.**.

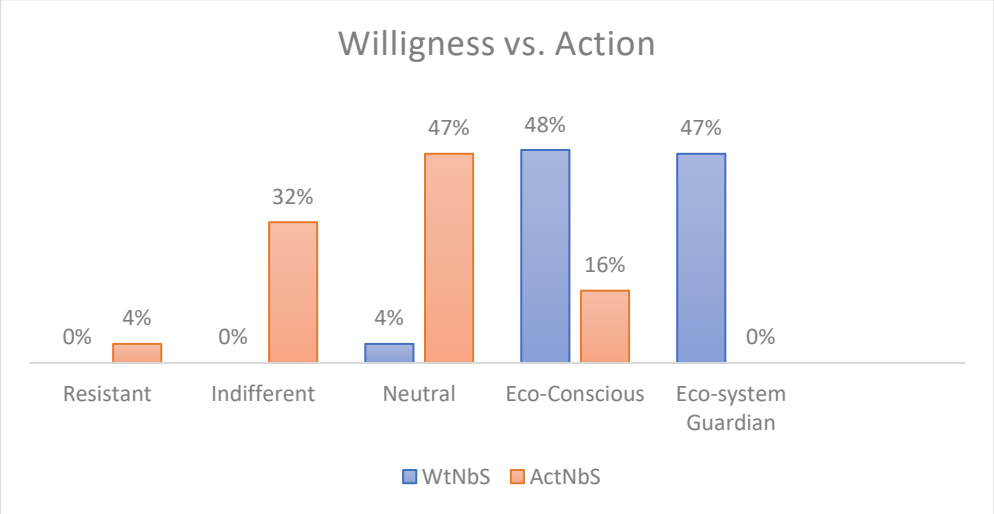


Figure 16 Scores comparison of Willingness and Action.

A deeper dive into the actual "greenness" of the respondents' garden reveals that the sample is rather evenly distributed between a garden that is covered with 25%, 50% and 75% plants with most of the group (34%) having a wide variety of plants in the garden. These results cannot be compared to the survey conducted by the municipality of Leeuwarden (see also section 4.1) because the area and sample sizes are substantially different. See Figure 17**Error! Reference source not found.** for detailed results.

Respondents that said their garden is covered with **less than 50% plants** were then asked to provide to explanations to their choices. The option "Other" was most often selected (55%) by the sample. From the pre-written answers, the most selected reason was "It costs too much time to maintain" (44%), followed by "I don't like doing gardening" (30%) and the 3rd most selected answer was "Maintaining a green garden cost too much money" (25%). Multiple answers were possible, meaning that the percentages don't sum to 100%. Interestingly, when the answers were ranked in order of importance, the order was:

(1) Other
(2) "I don't like gardening".
(3) "It costs too much time to maintain".
(4) "It costs too much money".

Meaning that even though "I don't like gardening" was chosen less often, when it was, it was seen as a more important reason than time.

Twenty-three people provided additional explanations for their choices. The answers were coded and given a simplified naming. Among the answers, the most common reason that was that “it’s a work in progress”, followed by “small garden” and “playground for children”. The last two could theoretically be combined and account for “lack of space”.

From the group who stated to have **more than 50% plants** in the garden, the main reasons to do so were:

(1) “I find a green garden to be prettier”.
(2) “I know biodiversity is declining and I want to support it”.
(3) “I want to make my garden more climate-resistant (more shade against heat-waves and better rain-absorption)”.

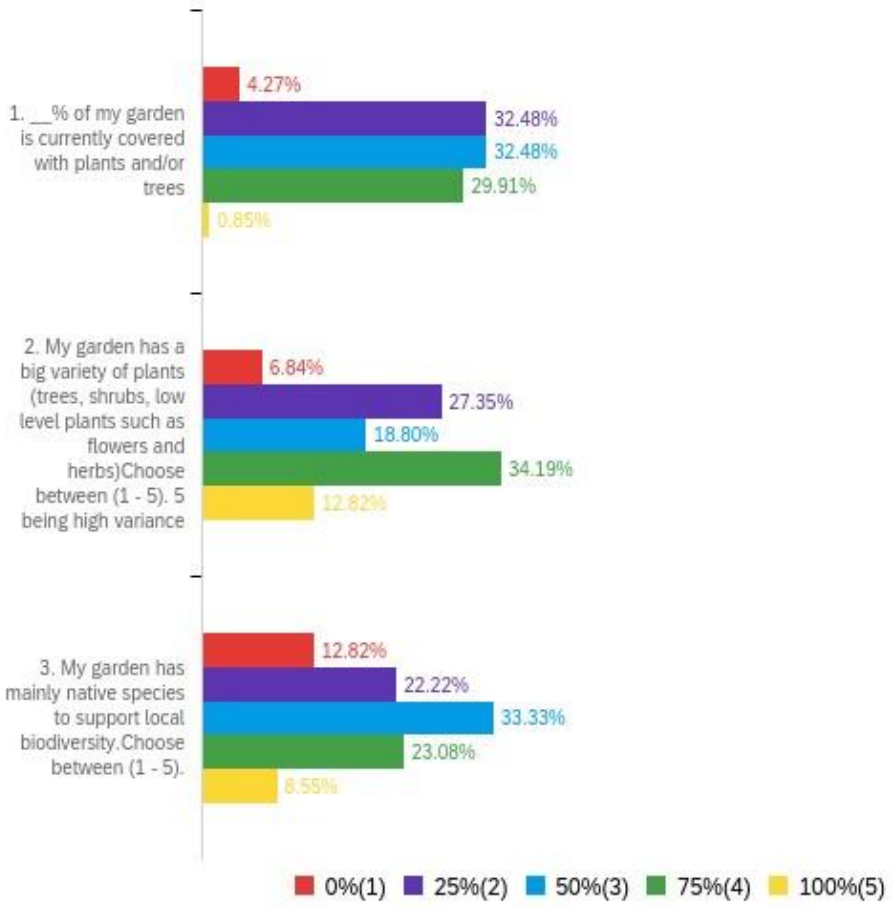


*Figure 17 Survey results from question 17: “Now, for each parameter, please choose the degree that represents your **current garden**”.*

Figure 18

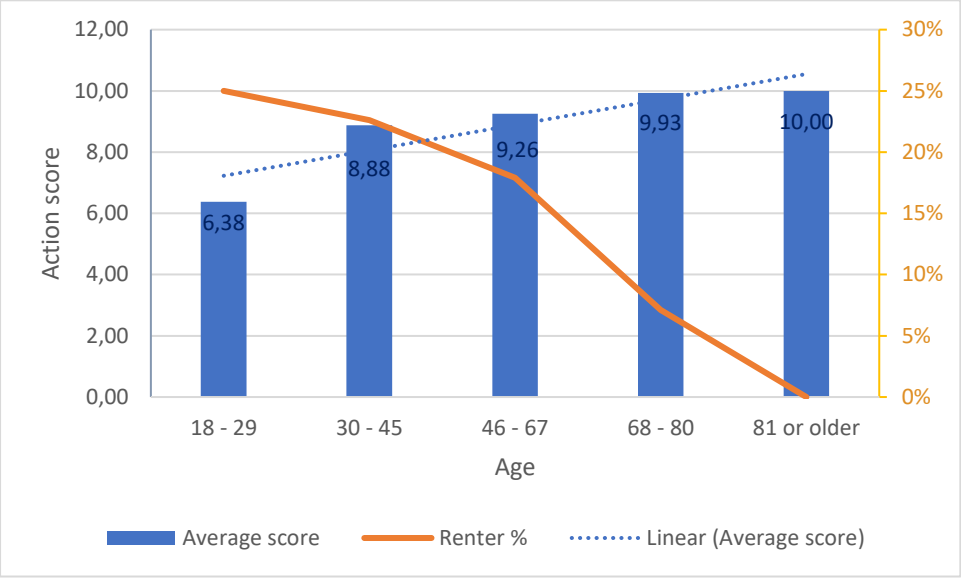
5.5.5.2 Statistical relationships

The results of the Action scores were also tested against the demographic variables to see whether they would influence the actual state the respondent’s gardens. According to the demographic profile of the sample, Action was tested against the variables age, educational level, income, ethnical background, gender and house ownership.

Among these variables, only annual household income has a statistical significance (P-Value = 0,0210) with moderate effect (Cohen's f' = 0,304) on the state of the garden. Moreover, a regression analysis using Relative Importance method shows that **income** has a high relative importance (35%) in the

regression model, indicating that it plays an important role in explaining the influence income has on the state of the garden.

The **age** of the respondents did not have a statistically significant relationship with the state of the garden, however, in this specific sample, the Action score did increase as the age increased. In addition, it did have the highest relative importance (37%) in the regression model. These results seem contradicting, but the small sample size (117) could have an influence. Another possible explanation is that some age groups had smaller participation rate than others. The group of 81 years and older consisted only of 1 participant and the group of 18-29 consisted only of 6 people. The results were also tested against house ownership type, to see whether renting the house can affect the greenery implementation rate in the younger or older age groups. Renting percentages decrease steadily as age increases, making the age group of 18-29 the biggest renting group (28%) of the entire sample. This could indeed explain the lower Action score for this group. Income could not explain the difference as it was more evenly distributed among the age groups an no pattern was evident.



5.5.6 Hypothesis 2 – NEP vs Action

Hypothesis number 2 assumes that people who score higher on the NEP (New Ecological Paradigm) scale will not have a higher Action score, while using the CIT (Contextual Interaction Theory) to explain the gap.

Similar to the methods and results of H1, also for H2 two tests were used to prove the validity of the hypothesis. The first used Excel to count the number of respondents that had matching NEP and Action scores (For example, Wv^A/Wv^B AND $ActNbS^A$/ $ActNbS^B$ or vice versa) and represent it a percentage of the total sample. This method allowed for more flexibility in score correlation rather than focusing only on matching extreme scores (For example Wv^A AND $ActNbS^A$). The results indicate that **82%** of respondents showed a **gap** between their beliefs and their actions, therefore proving the hypothesis correct.

The second test used statistical significance to see whether a valid relationship can be established between the two variables. For the sample group of 119 respondents, there was a weak, positive, linear correlation (P-value = 0,0439, Pearson's r = 0,187). The Pearson's r was recommended by Stats-

iQ since all relevant assumptions were met (sample size, no outliers and having a linear relationship). It's worth noting that the addition of two responses (from 115 to 117) shifted the result from no relationship to a positive correlation, highlighting the impact of sample size.

Given the explanation above, i.e., small statistical effect and the size of the sample, in combination with the results of the excel analysis, it is concluded that, once again, the hypothesis was proven correct. A strong pro-environmental worldview cannot be solely relied upon to lead people to make their gardens more sustainable. While a strong worldview score can motivate, other factors play a crucial role in shaping the final decision. These factors will be further elaborated on in the following section.

P-Value	0,0439
Effect Size (Pearson's r)	0,187
Confidence Interval of Effect Size	0,00534 to 0,356
Sample Size	117

5.5.6.1 Categorization according to the CIT

Contextual Interaction Theory (CIT) identifies three key actor characteristics demonstrated by empirical evidence to explain the course and results of a policy (H. Bressers, 2009). By understanding and analysing the motivation, cognitions, and resources of actors (in this thesis, referred to as the citizens and the municipality), it is possible to make predictions about the outcomes of their mutual interactions. In other words, aligning the actor's three characteristics predicts successful cooperation and therefore successful implementation of the policy. For the case of the municipality of Leeuwarden, which is seen for the sake of simplicity as one harmonious unit, it's assumed that its' motivation, resources and cognition align with the end goal of making Leeuwarden more sustainable. Thus, the focus is given to analysing the citizen's characteristics and testing whether it is also the case for them and where are the differences.

Due to the nature of the NEP's construction, it combines elements that represent both the cognition and motivation (as previously explained in the conceptual model). The results show that the majority of the sample shares common attitudes related to environmental sustainability (=cognition) and is highly willing (=motivation). At the same time, their implementation rates remain low. Using the other factors that were collected during the survey could help shed more light on the reluctance to have green gardens.

The reasons that were selected to explain why people chose to have less than 50% of their garden covered with plants were categorized according to the CIT. All reasons that were selected at least one time (n>0), or freely inputted by the respondents were included in Table 11.

Table 11 Characterization of given reasons for not have a green garden according to the CIT.

EWv → ActNbS	**Motivation**	**Cognition**	**Resources**
General reasoning	• Garden tiles are more practical.	• It's the responsibility of the municipality to make sure that the city is green. • More tiles make my garden look	• It costs too much time to maintain. • Maintaining a green garden cost too much money.

		more organized and representative.	• A green garden is physically too hard for me to maintain.
Factors that specifically address NbS	• I don't like doing gardening. • I don't want to have weeds in my garden. Tiles prevents weeds.	• Most of my neighbours have a garden with a lot of pavement.	• There is too much choice, and I don't know how to make my garden green.
Factors that are not in row 1+2 which respondent can add	• Cats doing their needs.		• It's a work in progress. • Small garden. • Short term renting

According to the theory of CIT, resources, cognition and motivation are interconnected and re-enforce each other. The table above paints the same picture. It seems that respondent's preference for tiles is driven by the motivation for low maintenance, practicality and weed-free gardens, while at the same time they perceive such gardens as representative and follow suit with the norm of the neighbourhoods if others have such gardens as well (cognition). This relationship works also in reverse, as representativeness is promoting such 'organized' gardens. Time and money were selected most often as missing resources, along with lack of knowledge. Once again, directly linked to motivation for low maintenance and strengthened by the cognition that there is no need to invest more money and time in the garden since it already looks representative. Also, not having time and money promotes the cognition that it's the responsibility of the municipality to ensure greenness of the city. These are just a few examples, and there are more interrelationships that can be established using Figure 19, but is it clear that policymakers should take them all into consideration when designing future policies.

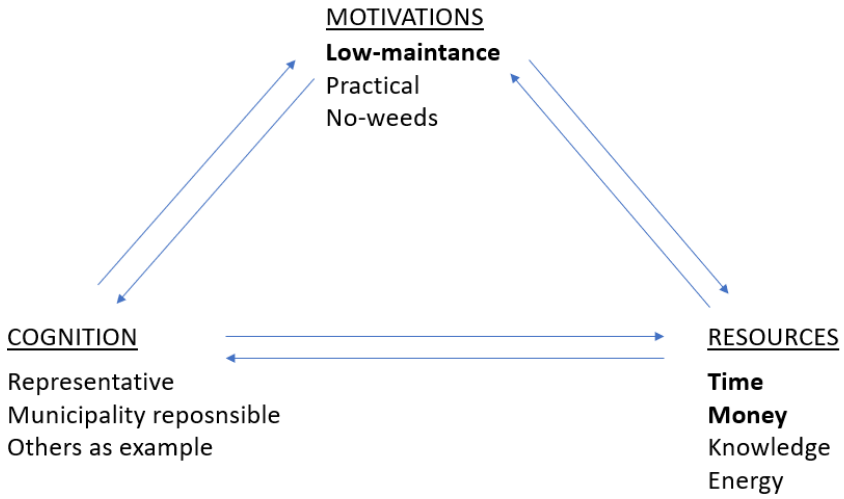


Figure 19 Interrelationships between actor characteristics. Reasons in bold were selected most often and therefore have a higher impact.

5.5.7 Policies

In this section respondents were asked two questions: whether they knew that the municipality of Leeuwarden provides subsidies to greening gardens and what in their opinion would be good policies to support citizens with the transition.

Only a third of the respondents knew about the existence of the subsidies from the municipality of Leeuwarden. This number corresponds to a previously conducted survey by the municipality self, where 67% did not know about the subsidies and 33% did know (Gemeente Leeuwarden, 2021).

Findings show that **discounts on sewage tax** is the most selected policy preference (49%), followed by **free access to gardening coaches** (46,5%) and more subsidies (42,1%). The first two options are not currently available by the municipality of Leeuwarden, but given the popularity among the respondents, could be very interesting policies to investigate further. The option to provide personal advice at home such as a garden coach, or "water-coaches", is an already existing option provided by many municipalities in the Netherlands (Amersfoort Rainproof, n.d.; Gemeente Amsterdam, 2022; LOE media, 2022). In fact, some municipalities combine under the general name of 'sustainability coaches', both tips on climate adaptation and energy management (Gemeente Ermelo, 2023). Discounts on sewage tax, are on the other hand, are less popular. In 2017, municipality of Altena, Nertherlands, received a lot of media attention for the idea of implementing such discount (Mediaplein Altena net, 2017; Patrick Jansen, 2021). However, no evidence is found on their website to prove it.

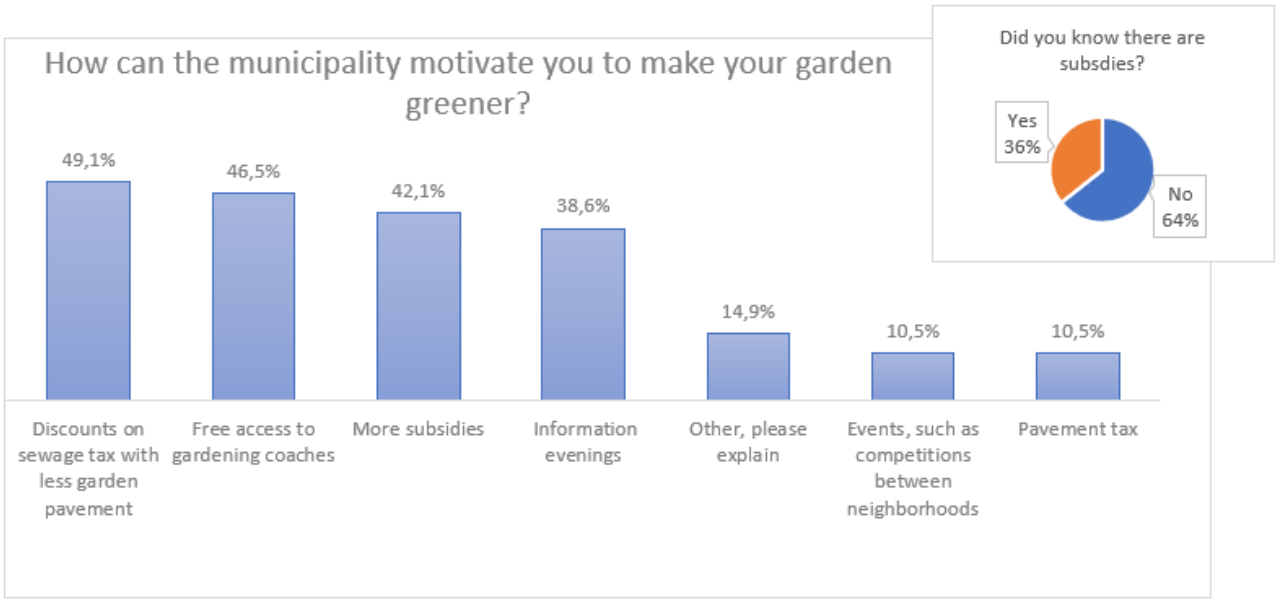


Figure 20 Distribution of the most often selected answers to the question: "How can the municipality motivate you to make your garden greener?".

The "Other" category includes freely inputted suggestions from the respondents. Answers included the following (free translation from Dutch, wording could defer):

- More campaigning in different media.
- City itself as a role model.
- City should propose a maximum m^2 of pavement in relation to the overall garden area.
- Positive nudges work best. Provide special support to those who cannot physically maintain a green garden and therefore choose for pavements.

- More neighbourhood visits together with a gardener.
- Let the municipality first make the neighbourhoods greener.
- Help elderly and handicap people with the maintenance of their garden.
- Give free seeds with clear instruction for planting.

5.6 Interview

One semi-structured interview was conducted on 16/6/23 with the responsible person for “Operatie Steenbreek” in the municipality of Leeuwarden. "Operatie Steenbreek" is an initiative operating on a national scale that cooperated with local governments to encourage and assist residents in transforming paved areas into green spaces.

The interview lasted approximately 1.5 hours and included questions about the municipality's approach to incentivize homeowners, achievements, and challenges they faced so far. The guide to the interview, including all questions can be found in appendix 10.3.

In this chapter the main anecdotes of the interview are summarized.

Cognition

In the first years in the position, there was lot of attention needed to create awareness, but after 5 years the interviewee feels that it’s time for new input: “*… that is already a lot further with green gardens and sustainability and recycling, that is now going very fast. It's really such a hype now…*”.

One way to measure the increase in awareness is track the number of citizens that ask for subsidies for sustainable initiatives on public spaces: “*There is an increase in the amount of request I get, such as, vegetable gardens, façade gardens and that is without the increase in number of ‘adopted trees’*”. Also, subsidies that specifically meant for climate adaptation measures such as green roofs and garden greening are increasing: “*I think for the first time this year we really think: okay, we're going to reach the subsidy ceiling. We haven't had that in previous years*”.

Also, within the municipality the awareness is growing, especially with the new city council focusing more on green infrastructure. For example, trees are also being considered during the design phase of new development projects and not only at the last phases. The release of the new website “Groen Leeft in Leeuwarden” makes the information more accessible. No data was available during the interview for assessing if the number of visitors of the website is increasing.

Selecting locations of events

Each neighbourhood is visited five times a year. Citizens are invited to physically bring their removed tiles and for each tile they receive a free plant that they can choose themselves. Not all neighbourhoods have been visited yet. Priority is given to neighbourhoods with a higher risk for heat stress and water nuisance or to ones that are in the process of construction, such replacement of the sewage system.

Motivation

From a motivational perspective, the preference is to work with positive incentives. In order to increase contact with the citizens there is most cooperation with neighbourhood panels and ‘green’ groups from the city and the villages. Since most land is in private hands, the municipality cannot force people to have green gardens: “*you can't force people, so you try to seduce them and make it easy, but you can also inspire them by what you do yourself... Leeuwarden is a are a part of the national*

competition as a city as a whole, but we don't want to use data on a neighbourhood scale to compare neighbourhoods or organize competitions against each other".

Lack of resources such as time, money and knowledge are highlighted as background factors that also shape interest and energy. Cultural aspects such as norms and values are also mentioned as possible factors.

Policies

Acknowledging the background factors influencing motivation, the municipality is trying mainly to use subsidies and making the steps as easy as possible such as organizing free "tile taxi's" and giving discounts for water reservoirs in the shops instead of filling-in subsidy forms. The neighbourhood events are mainly used to increase knowledge, which also includes one-on-one meetings where citizens are helped with their design questions.

Citizens from demographic groups who need more support respond best to very tailored projects that guide them in every step and take the burden of their shoulders: "*Subsidy works for a group, but that doesn't work for everyone, because there is also a group that found it very complicated to apply for that subsidy, maybe they don't speak Dutch very well*". Unfortunately, these kinds of projects are very intensive and require a lot of resources from the municipality, so they don't occur often.

When asked about the focus for the future the interviewee mentioned:" how *can I reach as many people as possible in the most personal way possible".*

6 Discussion

The primary objective of this research was to explore whether pro-environmental worldviews could serve as a reliable indicator of the degree of biodiversity and climate resilience in ones' gardens. Two hypothesises were made, using the NEP (New Ecological Paradigm) as the independent variable, and "Willingness" and "Action" as the dependent variables. It was predicted that a strong pro-environmental worldview, measured by the NEP scale would correlate with a high willingness to take proactive measures for a green garden, but not effectively with implementation of such measures. While not all results were statistically significant, the results demonstrated clear trends to support both hypothesises. The most important findings of this research are that the people affiliate themselves with an ecological worldview and show an even higher willingness to demonstrate these ideas, but nevertheless are hindered by factors that are mainly attributed to lack of resources and motivation. And while the municipality of Leeuwarden has set policies to support its' citizens in the transition to a more sustainable environment, the citizens themselves see financial discounts and gardening coaches as more motivating policy instruments than subsidies.

So far, the entire document was structured according to four main sections: worldviews, willingness action and policy analysis. It will be therefore appropriate to discuss the most important findings in the same order.

When focusing on worldviews, the high NEP scores of the sample are consistent with findings from other researchers, even on a very large sample of 14.000 face-to-face interviews (Gansser & Reich, 2023). The high scores were truly unexpected given the continuous degradation of the planets' ecological systems, resource depletion in general, and the multiple observations of completely tiled gardens in Leeuwarden, in particular. From a pessimistic lens, it could seem an utterly unnecessary measurement, but on the other hand, following the Theory of Planned Behaviour (TPB), this is good news. Positive attitude is the most important driver for willingness, which is a necessary step before

the behaviour itself (Ajzen, 1991). Thus, without pro-ecological attitude, we can expect a negligible change in behaviour, if at all. One possible way to explain the relative high scores is that awareness to sustainability importance is rising in the Netherlands, with three quarters of the Dutch population being concerned about the effects of climate change (Statistics Netherlands, 2021) and both public and private sectors are making statement about their ambitions to transition to a more sustainable future. Another possible explanation that might have some effect on the results is what is known as the 'response bias'. Meaning that mostly people who already have interest in the topic of sustainability, will make the effort in filling in the survey. Or, alternatively, respondents giving socially desirable answers, which in this case are more pro-environmental.

Another point to be mentioned is regarding the content of the NEP statements themselves. When analysing the results per statement and not per dimension, I came across an intriguing pattern. In certain answers that were designed to reflect a pro-ecological opinion, I often noticed an opposite response, even among respondents with a clear pattern of pro-NEP. For example, statement number 6: "The earth has plenty of natural resources if we just learn how to develop them", should receive a "disagree" in a pro-NEP mindset, while the sample answered the opposite. It feels as an outdated statement that does not reflect our current technological knowledge in extracting resources, and as we now know, humanity has probably more fossil fuels than it should be using (Harvey et al., 2013). So, while the consequences of extracting resources are devasting for the planet, the statement itself is not reflecting it, which could alter the end result. It seems that other researchers have similar thoughts but criticizing other statements (Lalonde & Jackson, 2002; R. L. Smith & Coleman, 2018). Perhaps the NEP could benefit from a third revision, but until then, it is still the most used and studied scale for environmental concern in the world (Dunlap et al., 2000).

In the Action section, people with high green coverage in their garden do so mostly because they "find a green garden to be prettier", and only at a second and third ranking, reasons that are attributed to pro-NEP scores: "I want to support biodiversity" and "I want to make my garden more climate resistant". Thus, motivation driven by self-interest is stronger than an ideological motivation. This finding supports a recent study that measured the effects of environmental concerns and the NEP on environmental behaviour. It was found that egoistic concerns are the strongest influencer of environmental conscious behaviour. Altruistic concerns about the consequences of environmental degradation also influence behaviour but at a much lesser degree. Thus, people are more likely to care about their own behaviour if they believe they are personally affected by environmental issues (Gansser & Reich, 2023). This conclusion provides practical and useful communication strategy to policymakers and opens the opportunity to a explain the simultaneous benefits for both public and private sector Zooming in on the topic of this study, the municipality already provides detailed and clear information about the "heat island effect" and future water nuisance caused by heavy rainfalls. The municipality's website explains citizens about the cooling advantages of replacing pavement with plants and water absorbance capacity of soil and roofs (Gemeente Leeuwarden, n.d.). Accessibility to this information could be improved but, with regards to biodiversity, the main communication message circles around altruistic behaviour such as "save the bees and the insects". While instead, people should better understand the implications biodiversity loss would have on their own lives as with water and heat.

Using the Contextual Interaction Theory (CIT) to understand the obstacles that hinder citizens from applying Nature-based Solutions (NbS) helps to highlight the interrelationships between these obstacles. The most commonly selected obstacles were identified as time constraints, financial limitations, and a preference for low maintenance gardens. Lack of knowledge was also mentioned,

although less often. These results are confirming the impressions that the municipal official shared during the interview. While providing subsidies to address the lack of financial resources may be a viable solution for one group of people, others might benefit more from approaches that primarily target cognitive factors, such as tailored informative campaigns. These campaigns could indirectly influence the perception of resource scarcity (e.g., time or money). For instance, promoting the benefits of having a biodiverse green garden and employing nature-friendly gardening techniques, such as leaving leaves on the ground during the winter or reducing hedge pruning frequency to encourage plant blooming, as well as reducing the frequency of grass mowing, can result in less time-consuming and cost-effective gardening practices. Even better, as one of the respondents noted, the municipality should continue its efforts to setting the example of such eco-friendly practices in public spaces to change the perception. Given the fact that 97% of the sample is willing to have an English cottage style or a wild garden, is already a good beginning.

The analysis regarding preferred policies revealed that subsidies are the third most requested support from the municipality. Yet, two thirds of the sample didn't know about their existence. These results remained consistent even after the municipality had previously inquired about this issue two years ago. Despite the municipality's efforts to raise awareness through a new website ("Groen leeft in Leeuwarden") which provides, among others, information on available subsidies, it may not be sufficient to effectively increase awareness for them. Research in Son en Breugel and Rucphen, two municipalities in the Netherlands, investigated the effects of financial driven policies on behavioural change. It found that advertising the subsidies in the relevant tax bill (for example the sewage tax bill) and accentuating the social norms surrounding climate-adaptive behaviour leads to a higher interest in the subsidy. Examples from the research include sentences that promote social cohesion and feeling of communal responsibility such as "Will you also participate?", "more and more Dutch people have disconnected their rainwater drainage" and "the more people in your street head off, the smaller the chance of water nuisance" (van den Broek et al., 2020). This is an interesting addition that wasn't included in the current research design. One possible way of testing the effects of social cohesion and community engagement could have been to add in the preferred policies section of the questionnaire, an additional option of "promotion of community gardens".

The research contains a few limitations regarding the sample heterogenicity. The data collected contained a relatively small sample, focusing specifically on residents of Leeuwarden, predominantly with a Dutch ethnical background and in the ages of 30-67. A smaller sample produces weaker statistical result that are less stable. This is the case for hypothesis two (H2), where it is possible that a larger sample will prove the hypothesis to be false. In addition, ideally, the participation rate of those younger than 30 and older than 67 would be higher. One way to explain the lower response rate from the group of <67 is the main data collection method of using QR codes. Not everyone is proficient with this technology or is willing to fill in digital forms. The lack of data on this group could have also affected the results of the selected preferred policy.

As described in the conceptual framework in chapter 3, the NEP scale includes elements of knowledge and not only attitudes. This as well, could be a limiting factor for some respondents. As part of the data collection methods, I asked some people to fill in a printed version of the questionnaire, which allowed me to observe the filling-in process and ask a few side questions. I noticed that while people had obvious pro-nature opinions, they filled-in "unsure" in several pro-NEP statements. A recommendation for future research will be to have more in-person questionnaires or interviews, even though no correlation was found between educational level and NEP response.

Nevertheless, the findings explain in this chapter still shed insights that could be valuable for policymakers in other Dutch cities as well. They emphasise that respondents, across different demographic groups, share a pro-ecological worldview and a high willingness degree, which are both

necessary precursors of positive environmental behaviour. Possible obstacles that hinder implementation of green gardens were evaluated and analysed in order to propose fitting policies to aid the transition towards greener cities.

7 Conclusions

In the pursuit of sustainable urban environments, understanding the intricate connections between attitudes, behaviours, and policy preferences is crucial. This research focused on the contribution of citizens to urban sustainability through their private gardens. In particular, it aimed to identify the relationship between ecological worldviews, the implementation of green gardens and the identification of the best policy approaches. The research used both quantitative and qualitative research methods. In a semi-structured survey residents of Leeuwarden with gardens were surveyed about their beliefs, preferences, and the state of their gardens. In addition, an interview with a municipality official provided information on the existing policies and practices.

The main research question was as follows:

How do pro-environmental worldviews influence homeowners in Leeuwarden to adopt climate change mitigation and adaptation measures, particularly those related to green gardens, in the scope of their own homes?

Accompanied by the following sub-questions:

1. Does an ecological worldview influence willingness, and consequently implementation, of NbS in private gardens?
2. Which other factors influence implementation of NbS in private gardens?
3. What strategies can be employed to effectively promote and implement greener gardens in the context of Leeuwarden?

7.1 Pro-Environmental Worldviews and Willingness: The Foundations of Change

To answer the first research question, three elements were studied separately, namely the worldviews, willingness, and implementation scores of the respondents. In the first part, the exploration focused on pro-environmental worldviews, evaluated through the New Ecological Paradigm (NEP) scale. The majority of respondents demonstrated high scores, indicating a strong commitment to ecological awareness. Given the continuous deterioration of the earth's environmental state, such a high NEP score was not expected from the sample. Further statistical analysis was conducted to see whether demographic parameters would have an influence on either NEP, willingness, or action scores. Higher education and gender (females), not necessarily a combination of the two, are parameters that a likely to increase the willingness to have a green garden. Out of the two parameters educational level is a stronger predictor than gender. Action scores were found to be statistically influenced by a level of income and age. Education, income and age are further addressed in the recommendation chapter 7.3.

The relationship between willingness and action scores revealed the expected result that matched the second hypothesis. Respondents with high NEP scores showcased willingness, yet the actual implementation score was low and influenced by a myriad of factors. It can be thus concluded that an ecological worldview is linked to an increased motivation to have a green garden and therefore, can influence people, but is not a sufficient factor to drive implementation. Based on this conclusion and the results of the analysis, both hypotheses are proven to be correct.

These findings align well with the tenets of the Theory of Planned Behavior (TPB) and the Contextual Interaction Theory (CIT). According to TPB, positive attitudes towards a behavior, such as embracing sustainable gardening, act as crucial precursors to fostering willingness to engage in that behavior. In other words, without willingness there cannot be an action. In addition, both the CIT and TPB recognize that external contextual factors influence the end outcome. In fact, the answer to research question one provides a positive outlook and serves as a foundational element to policymakers – the citizens are willing but are facing challenges to implementation which is where an effective policy can play an important role.

7.2 Willingness and Action: Bridging the Gap

To answer sub-research question number two, both the interview and questionnaire were used and analyzed with the aid of the Cultural Interaction Theory (CIT) to identify possible factors that could influence the implantation. The result of the analysis showed that citizens that are willing to make their homes greener are experiencing obstacles in the form of lack of time, money, or knowledge, show preference for low-maintenance gardens and often perceive gardening as an undesirable activity. On the other hand, citizens that do have green gardens, do so because they find them more attractive which is not a value driven but rather an egoistic reasoning. The use of CIT illuminated the interdependencies among motivation, cognition, and resources, highlighting the importance of holistic approaches. There is a need for tailored policies and targeted communication strategies to effectively mitigate the obstacles mentioned by the respondents. More details on the recommended strategies can be found in sub-chapter 7.3.

7.2.1 Preferred Policies: Navigating Motivation and Support

At the very end of the questionnaire, the respondents were asked to self-evaluate which policy would be most successful in promoting greener gardens. Respondents were given a list of policy instruments that was designed to address the three categories of the CIT, namely, motivation, cognition, and resources. The analysis of preferred policies provided valuable insights, especially since such a questionnaire was not previously conducted by the municipality. Notably, financial discounts on sewage tax and the provision of gardening coaches generated greater interest than direct subsidies. The study also revealed the need for increased awareness about existing subsidies, suggesting the incorporation of social norms and community engagement strategies in promotional efforts.

7.3 Recommendations

The conclusion in the previous sub-chapters provided insights that helped achieved the first objective of the study, namely, to obtain a clearer understanding of how people, either intentionally or unintentionally, support urban sustainability and biodiversity conservation through their private outdoor spaces.

To promote climate-positive behaviour and address the obstacles faced by citizens, several recommendations have been proposed based on the findings and discussions presented in this study. The recommendations below also provide the answer to sub- question number three and to the second objective of the thesis.

Policy choices:

1. **Implementation of Gardening Coaches:** The suggestion to implement free gardening coaches is aligned with findings in sub-chapter 7.2.1. Implementing free gardening coaches as a policy is highly advisable, as they were ranked second by the citizens, are being currently applied by other municipalities, tackle the mentioned obstacles (time, money and knowledge) and

strengthens all three aspects of the Contextual Interaction Theory (CIT), therefore increasing the chances of implementation success. Gardening coaches not only provide information but also offer a personable experience where citizens can ask questions and receive personalized guidance.

2. **Piloting Tax Discounts:** The most preferred policy by the respondents was to have reduction on wastewater taxes. The discussion chapter addressed relevant research and practices in other municipalities that aim at improving the use of financial incentives. They found that where advertisements were placed and the language that was used, improved the success rate of usage. It is therefore recommended to pilot the effect of tax discounts with a small group of citizens to assess its impact on behaviour change. When directly advertised in the normal bills people receive and mentioning the social norms, the chance of success will increase.
3. **Assistance for Vulnerable Groups:** Based on the responses from the respondents in the survey, it is advised to consider providing special physical assistance for elderly and handicapped individuals. This will further demonstrate inclusivity and will support their participation in climate-adaptive actions.
4. **Municipal Role Model:** The municipality is encouraged to continue acting as a role model for its' citizens and continue her efforts to green the city and apply more ecosystem friendly gardening practices. This recommendation is also based on the responses from the survey.

Communication strategy:

5. **Diverse Communication Channels:** Referencing again to the research conducted by other municipalities, and the finding from the survey that most respondents were not aware to the available subsidies, it is advised to try to increase awareness by advertising also through addressed letters and flyers, since the website may primarily attract individuals who are already interested in the topic.
6. **Emphasizing Biodiversity Benefits:** It is advisable to place more emphasis on the topic of biodiversity as it has a positive effect on both natural systems and on human living comfort.
    a. From altruistic to egoistic: as mentioned in the discussion chapter, changing the message from an idealistic and altruistic motivation ("save the bees") to an egoistic motivation ("vegetation reduces heat stress and therefore increase your living comfort" or "Our everyday food supply strongly depends on the health of our ecosystems") can increase the chances of behavioural change.
    b. Addressing Identified Obstacles: Communication should clearly address the obstacles that were identified by the citizens, therefore emphasizing the benefits rich biodiverse gardens have on time and cost savings in the long run.
    c. Changing Perception of Gardens: Using the principles of the CIT, changing the way people view what seems to be representable and/or low-maintenance gardens is a key to change cognition and therefore also influence motivation and resource allocation.
7. **Educational programmes:** Degree of educational attainment was found to be a factor that increases the willingness to have a green garden. Providing access to educational programs/campaigns on the environmental awareness across all ages, continuous to be an important tool for achieving behavioural change.

8 References

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. *Action Control*, 11–39. https://doi.org/10.1007/978-3-642-69746-3_2

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Amersfoort Rainproof. (n.d.). *Gratis regenwateradvies Wees slim: vang regenwater op in je tuin!* Retrieved July 7, 2023, from https://amersfoortrainproof.nl/hulp-nodig/regenwatercoaches

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471–499. https://doi.org/10.1348/014466601164939

Beatley, T. (2011). *Biophilic Cities - Integrating Nature into Urban Design and Planning*. Island Press.

Beumer, C. (2018). Show me your garden and I will tell you how sustainable you are: Dutch citizens' perspectives on conserving biodiversity and promoting a sustainable urban living environment through domestic gardening. *Urban Forestry and Urban Greening*, *30*, 260–279. https://doi.org/10.1016/j.ufug.2017.09.010

Bockarjova, M., Botzen, W. J. W., van Schie, M. H., & Koetse, M. J. (2020). Property price effects of green interventions in cities: A meta-analysis and implications for gentrification. *Environmental Science & Policy*, *112*, 293–304. https://doi.org/https://doi.org/10.1016/j.envsci.2020.06.024

Bressers, H. (2009). *From public administration to policy networks: Contextual interaction analysis.* (pp. 123–142). Presses polytechniques et universitaires romandes / Haupt verlag. https://research.utwente.nl/en/publications/from-public-administration-to-policy-networks-contextual-interact

Bressers, H., Bressers, N., Kuks, S., & Larrue, C. (2016). The governance assessment tool and its use. *Governance for Drought Resilience: Land and Water Drought Management in Europe*, 45–66. https://doi.org/10.1007/978-3-319-29671-5_3/FIGURES/6

Bressers, Jt., Klok, P., ThA Bressers, H., Jan Klok, P., O, L. J., & Professor, J. (2000). *Explaining Policy Action: A Deductive but Realistic Theory*. http://www.utwente.nl/cstm/ukCSTMWEB-site

CBS. (2021). *Kerncijfers wijken en buurten*. https://www.cbs.nl/nl-nl/maatwerk/2023/14/kerncijfers-wijken-en-buurten-2021

Chen, W. Y., & Jim, C. Y. (2010). *Resident Motivations and Willingness-to-Pay for Urban Biodiversity Conservation in Guangzhou (China)*. https://doi.org/10.1007/s00267-010-9478-2

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, *68*(1), 129–138. https://doi.org/10.1016/j.landurbplan.2003.08.003

Clayton, S., & Myers, G. (2015). *Conservarion Psychology - understanding and promoting human care for nature* (Second). Wiley Balckwell.

Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., Maginnis, S., Maynard, S., Nelson, C. R., Renaud, F. G., Welling, R., & Walters, G. (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. In *Environmental Science and Policy* (Vol. 98, pp. 20–29). Elsevier Ltd. https://doi.org/10.1016/j.envsci.2019.04.014

Cohen-Shacham, Walters G, Janzen C, & Maginnis S. (2016). Nature-based solutions to address global societal challenges. In *Nature-based solutions to address global societal challenges*. IUCN International Union for Conservation of Nature. https://doi.org/10.2305/iucn.ch.2016.13.en

Cui, M., Ferreira, F., Fung, T. K., & Matos, J. S. (2021). Tale of two cities: How nature-based solutions help create adaptive and resilient urban water management practices in singapore and lisbon. *Sustainability (Switzerland)*, *13*(18). https://doi.org/10.3390/su131810427

Dake, K. (1991). Orienting Dispositions in the Perception of Risk: An Analysis of Contemporary Worldviews and Cultural Biases. *Journal of Cross-Cultural Psychology*, *22*(1), 61–82.

Dell'Anna, F., Bravi, M., & Bottero, M. (2022). Urban Green infrastructures: How much did they affect property prices in Singapore? *Urban Forestry & Urban Greening*, *68*, 127475. https://doi.org/https://doi.org/10.1016/j.ufug.2022.127475

Derkzen, M. L. ;, Van Teeffelen, A. J. A. ;, & Verburg, P. H. (2016). *VU Research Portal Green infrastructure for urban climate adaptation: How do residents' views on climate impacts and green infrastructure shape adaptation preferences?* https://doi.org/10.1016/j.landurbplan.2016.05.027

Despotović, J., Rodić, V., & Caracciolo, F. (2021). Farmers' environmental awareness: Construct development, measurement, and use. *Journal of Cleaner Production*, *295*, 126378. https://doi.org/10.1016/J.JCLEPRO.2021.126378

Dorst, H., van der Jagt, A., Raven, R., & Runhaar, H. (2019). Urban greening through nature-based solutions – Key characteristics of an emerging concept. In *Sustainable Cities and Society* (Vol. 49). Elsevier Ltd. https://doi.org/10.1016/j.scs.2019.101620

Dorst, H., van der Jagt, A., Runhaar, H., & Raven, R. (2021). Structural conditions for the wider uptake of urban nature-based solutions – A conceptual framework. *Cities*, *116*, 103283. https://doi.org/10.1016/J.CITIES.2021.103283

Dunlap, R. E., & Van Liere, K. D. (1978). The "New Environmental Paradigm." *The Journal of Environmental Education*, *9*(4), 10–19.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, *56*(3), 425–442. https://doi.org/10.1111/0022-4537.00176

European Commission. (2020). *EU Biodiversity Strategy for 2030*. https://ec.europa.eu/research/environment/index.cfm?pg=nbs

European Commission - Research and innovation. (2023, April 14). *The EU and nature-based solutions*. Https://Research-and-Innovation.Ec.Europa.Eu/Research-Area/Environment/Nature-Based-Solutions_en.

European Environment Agency. (2018a). *Soil sealing and ecosystem impacts*. https://www.eea.europa.eu/data-and-maps/dashboards/soil-sealing-and-ecosystem-impacts

European Environment Agency. (2018b). *Urban Green Infrastructure*. https://www.eea.europa.eu/data-and-maps/dashboards/urban-green-infrastructure-2018

European Environment Agency. (2018c). *Urban tree cover*. https://www.eea.europa.eu/data-and-maps/dashboards/urban-tree-cover

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science and Policy*, *93*, 101–111. https://doi.org/10.1016/j.envsci.2018.12.033

Gansser, O. A., & Reich, C. S. (2023). Influence of the New Ecological Paradigm (NEP) and environmental concerns on pro-environmental behavioral intention based on the Theory of Planned Behavior (TPB). *Journal of Cleaner Production*, *382*. https://doi.org/10.1016/j.jclepro.2022.134629

Gemeente Amsterdam. (2022, May 31). *Is jouw tuin al klaar voor de volgende hoosbui?* https://www.rainproof.nl/nieuws/meld-je-aan-voor-advies-van-een-rainproof-coach

Gemeente Ermelo. (2023, June 9). *Gratis advies van tuincoach, energiecoach of energieadviseur*. https://www.ermelo.nl/nieuws/gratis-advies-van-tuincoach-energiecoach-of-energieadviseur

Gemeente Leeuwarden. (n.d.). *Hoe klimaatbestendig is jouw buurt?* Groen Leeft in Leeuwarden. Retrieved July 9, 2023, from https://www.groenleeftinleeuwarden.nl/hoe-klimaatbestendig-is-jouw-buurt/

Gemeente Leeuwarden. (2020). *Uitvoeringsagenda 2021-2025 Klimaatadaptatie*.

Gemeente Leeuwarden. (2021). *Inwonersenqute- Tuin/balkon en klimaataanpassingen*.

Greaves, M., Zibarras, L. D., & Stride, C. (2013). Using the theory of planned behavior to explore environmental behavioral intentions in the workplace. *Journal of Environmental Psychology*, *34*, 109–120. https://doi.org/10.1016/J.JENVP.2013.02.003

Harvey, H., Orr, F. M., & Vondrich, C. (2013). A Trillion Tons. *Daedalus*, *142*(1), 8–25. https://doi.org/10.1162/DAED_A_00182

Hawcroft, L., & Milfont, T. (2009). The use and abuse of the New Environemtnal paradigm scale over the last 30 years - a meta analysis. *Environmental Psychology*. https://doi.org/10.1016/j.jenvp.2009.10.003

Jackson, T., Begg, K., Darnton, A., Davey, A., Dobson, A., Ekins, P., Garnett, T., Gatersleben, B., Hallsworth, A., Holdsworth, M., Jacobs, M., Jones, B., Lee, A., Leveson-Gower, H., Levett, R., Lucas, K., Manoochehri, J., Massey, M., Michaelis, L., … Uzzell, D. (2005). *Motivating Sustainable Consumption a review of evidence on consumer behaviour and behavioural change a report to the Sustainable Development Research Network*. www.surrey.ac.uk/CES

Kabisch, N., Korn, H., Stadler, J., & Bonn, A. (2017). *Theory and Practice of Urban Sustainability Transitions Natureebased Solutions to Climate Change Adaptation in Urban Areas*. http://www.springer.com/series/13408

Kabisch, N., Qureshi, S., & Haase, D. (2015). Human-environment interactions in urban green spaces - A systematic review of contemporary issues and prospects for future research. In *Environmental Impact Assessment Review* (Vol. 50, pp. 25–34). Elsevier Inc. https://doi.org/10.1016/j.eiar.2014.08.007

Kim, M. J., Hall, C. M., & Kim, M. (2023). What is significant for engagement in cycling and walking in South Korea? Applying value-belief-norm theory. *Travel Behaviour and Society*, *32*. https://doi.org/10.1016/j.tbs.2023.02.008

Lalonde, R., & Jackson, E. L. (2002). The New Environmental Paradigm Scale: Has It Outlived Its Usefulness? *The Journal of Environmental Education*, *33*(4), 28–36.

Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change*, *77*(1–2), 45–72. https://doi.org/10.1007/s10584-006-9059-9

Lin, B. B., Gaston, K. J., Fuller, R. A., Wu, D., Bush, R., & Shanahan, D. F. (2017). How green is your garden?: Urban form and socio-demographic factors influence yard vegetation, visitation, and ecosystem service benefits. *Landscape and Urban Planning*, *157*, 239–246. https://doi.org/10.1016/J.LANDURBPLAN.2016.07.007

LOE media. (2022, May 5). *Gratis tuinadvies voor inwoners van de Noord-Veluwe*. https://loemedia.nl/gratis-tuinadvies-voor-inwoners-van-de-noord-veluwe/

López-Mosquera, N., & Sánchez, M. (2012). Theory of Planned Behavior and the Value-Belief-Norm Theory explaining willingness to pay for a suburban park. *Journal of Environmental Management*, *113*, 251–262. https://doi.org/10.1016/J.JENVMAN.2012.08.029

Mata, L., Andersen, A. N., Morán-Ordóñez, A., Hahs, A. K., Backstrom, A., Ives, C. D., Bickel, D., Duncan, D., Palma, E., Thomas, F., Cranney, K., Walker, K., Shears, I., Semeraro, L., Malipatil, M., Moir, M. L., Plein, M., Porch, N., Vesk, P. A., … Lynch, Y. (2021). Indigenous plants promote insect biodiversity in urban greenspaces. *Ecological Applications*, *31*(4), e02309. https://doi.org/https://doi.org/10.1002/eap.2309

Mayer, F. S., & Frantz, C. M. P. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, *24*(4), 503–515. https://doi.org/10.1016/j.jenvp.2004.10.001

McNeeley, S. M., & Lazrus, H. (2014). The cultural theory of risk for climate change adaptation. *Weather, Climate, and Society*, *6*(4), 506–519. https://doi.org/10.1175/WCAS-D-13-00027.1

Mediaplein Altena net. (2017, July 19). *Idee "tuintegeltax voor Altena" houdt gemoederen flink bezig*. https://www.altena.net/nieuws/2017-07-19-6940-idee-tuintegeltax-voor-altena-houdt-gemoederen-flink-bezig

Meléndez-Ackerman, E. J., Santiago-Bartolomei, R., Vila-Ruiz, C. P., Santiago, L. E., García-Montiel, D., Verdejo-Ortiz, J. C., Manrique-Hernández, H., & Hernández-Calo, E. (2014). *Socioeconomic drivers of yard sustainable practices in a tropical city*. *19*(3). https://doi.org/10.5751/ES-06563-190320

Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., van Dijk, J., Vistad, O. I., Wilkinson, M. E., & Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment*, *579*, 1215–1227. https://doi.org/10.1016/J.SCITOTENV.2016.11.106

Patrick Jansen. (2021). Laat de tegeltaks het stenen tuinperk beëindigen. *Trouw*. https://www.trouw.nl/duurzaamheid-economie/laat-de-tegeltaks-het-stenen-tuinperk-beeindigen~b022688c/?referrer=https://www.google.com/

Rupprecht, C. D. D. (2017). Ready for more-Than-human? Measuring urban residents' willingness to coexist with animals. *Fennia*, *195*(2), 142–160. https://doi.org/10.11143/fennia.64182

Sabatier, P., & Jenkins-Smith, H. (1999). The advocacy coalition framework: an assessment. In *Theories of the policy process* (2nd ed., pp. 117–168). Westview Press.

Sari Kovats, R., Valentini, R., Bouwer, L. M., Georgopoulou, E., Jacob, D., Martin, E., Rounsevell, M., Soussana, J.-F., Beniston, M., Kajfez Bogataj, L., Corobov, R., Vallejo, R., Valentini, R., Bouwer, L., Georgopoulou, E., Jacob, D., Martin, E., Rounsevell, M., Soussana, J., … White, L. (2014). 23 Europe - Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In *Juliane Petersen*. Meriwether Wilson.

Sharmin, F., Sultan, M. T., Badulescu, A., Bac, D. P., & Li, B. (2020). Millennial tourists' environmentally sustainable behavior towards a natural protected area: An integrative framework. *Sustainability (Switzerland)*, *12*(20), 1–24. https://doi.org/10.3390/su12208545

Smith, R. L., & Coleman, C.-L. (2018, August 10). *Is the New Ecological Paradigm Scale Stuck in Time? A Working Paper*. https://doi.org/10.31274/sciencecommunication-180809-109

Smith, S. S. (2010). Forest Story Cards, a Visual Survey Tool. *Journal of Extension*, *48*(2).

Statistics Netherlands. (2021, June 9). *Three-quarters of Dutch concerned about impact of climate change*. https://www.cbs.nl/en-gb/news/2021/22/three-quarters-of-dutch-concerned-about-impact-of-climate-change

Stern, P. C., Dietz, T., Abel, T., & Guagnano, G. A. (1999). A Value-Belief-Norm Theory of Support for Social Movements: The Case of Environmentalism. *Kalof Source: Human Ecology Review*, *6*(2), 81–97.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The New Ecological Paradigm in Social-Psychological Context. *Http://Dx.Doi.Org/10.1177/0013916595276001*, *27*(6), 723–743. https://doi.org/10.1177/0013916595276001

Stichting Steenbreek. (2023). Tuinbezitters in Nederland. In *Stichting-Steenbreek*.

Stoknes, P. E. (2014). Rethinking climate communications and the "psychological climate paradox." *Energy Research and Social Science*, *1*, 161–170. https://doi.org/10.1016/j.erss.2014.03.007

UN Habitat. (2022). Envisaging the Future of Cities. *World Cities Report*.

United nations. (2018). *The World's Cities in 2018*. https://www.flickr.com/photos/thisisin

United Nations of Economic Department Affairs, S. D. P. (2018). *World Urbanization Prospects The 2018 Revision*.

van den Broek, E., Harms, J., & Smit, F. (2020). *Gedragsaanpak Financiele prikkels voor klimaatadaptieve maatregelen*.

Vanstockem, J., Vranken, L., Bleys, B., Somers, B., & Hermy, M. (2018). *Do Looks Matter? A Case Study on Extensive Green Roofs Using Discrete Choice Experiments*. https://doi.org/10.3390/su10020309

Wang, Z., Nie, L., Jeronen, E., Xu, L., & Chen, M. (2023). Understanding the Environmentally Sustainable Behavior of Chinese University Students as Tourists: An Integrative Framework. *International Journal of Environmental Research and Public Health*, *20*(4). https://doi.org/10.3390/ijerph20043317

Weible, C. M., Sabatier, P. A., & McQueen, K. (2009). Themes and Variations: Taking Stock of the Advocacy Coalition Framework. *Policy Studies Journal*, *37*(1), 121–140. https://doi.org/10.1111/J.1541-0072.2008.00299.X

White, R., Sasser, D., Bogren, R., & Morgan, J. (2009). Photos Can Inspire a Thousand Words: Photolanguage as a Qualitative Evaluation Method. *Journal of Extension*, *47*(3). https://www.researchgate.net/publication/265537173

WHO. (2021). *Green and New Evidence and Perspectives for Action Blue Spaces and Mental Health*. http://apps.who.int/bookorders.

Woonplaats Leeuwarden in cijfers en grafieken. (n.d.). AlleCijfers.Nl. Retrieved May 1, 2023, from https://allecijfers.nl/woonplaats/leeuwarden/

Xiao, C., & Buhrmann, J. (2017). The Structure and Coherence of the New Environmental Paradigm: Reconceptualizing the Dimensionality Debate. *Human Ecology Review*, *23*(1), 179–198.

Zardo, L., Geneletti, D., Pérez-Soba, M., & Van Eupen, M. (2017). Estimating the cooling capacity of green infrastructures to support urban planning. *Ecosystem Services*, *26*, 225–235. https://doi.org/10.1016/J.ECOSER.2017.06.016

Zölch, T., Henze, L., Keilholz, P., & Pauleit, S. (2017). Regulating urban surface runoff through nature-based solutions – An assessment at the micro-scale. *Environmental Research*, *157*, 135–144. https://doi.org/10.1016/j.envres.2017.05.023

9 Appendixes

9.1 NEP statements

Table 12 NEP statements according to the revised scale. Source: (Dunlap & Van Liere, 1978)

Table 1. Frequency Distributions and Corrected Item-Total Correlations for New Ecological Paradigm Scale Items[a]

Do you agree or disagree[b] that:	SA[c]	MA	U	MD	SD	(*N*)	r_{i-t}
1. We are approaching the limit of the number of people the earth can support	27.7%	25.2%	21.0%	16.0%	10.0%	(667)	.43
2. Humans have the right to modify the natural environment to suit their needs	4.1	28.5	9.2	33.9	24.3	(663)	.35
3. When humans interfere with nature it often produces disastrous consequences	44.6	37.6	4.0	11.2	2.5	(668)	.42
4. Human ingenuity will insure that we do NOT make the earth unlivable	7.8	23.5	21.5	24.4	22.7	(664)	.38
5. Humans are severely abusing the environment	51.3	35.3	2.6	9.3	1.5	(665)	.53
6. The earth has plenty of natural resources if we just learn how to develop them	24.4	34.8	11.3	17.5	11.9	(663)	.34
7. Plants and animals have as much right as humans to exist	44.7	32.2	4.7	12.8	5.7	(665)	.46
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations	1.1	7.4	11.3	30.9	49.4	(664)	.53
9. Despite our special abilities humans are still subject to the laws of nature	59.6	31.3	5.4	2.9	0.8	(664)	.33
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	3.9	17.9	13.8	25.9	38.5	(665)	.62
11. The earth is like a spaceship with very limited room and resources	38.0	36.3	7.5	13.4	4.8	(664)	.51
12. Humans were meant to rule over the rest of nature	13.5	20.4	8.2	23.9	34.0	(661)	.51
13. The balance of nature is very delicate and easily upset	45.9	32.8	5.9	14.1	1.4	(665)	.48
14. Humans will eventually learn enough about how nature works to be able to control it	3.2	20.1	24.2	27.9	24.6	(666)	.35
15. If things continue on their present course, we will soon experience a major ecological catastrophe	34.3	31.0	16.9	14.1	3.6	(667)	.62

[a]Question wording: "Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you STRONGLY AGREE, MILDLY AGREE, are UNSURE, MILDLY DISAGREE or STRONGLY DISAGREE with it."
[b]Agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicate pro-NEP responses.
[c]SA = Strongly Agree, MA = Mildly Agree, U = Unsure, MD = Mildly Disagree, and SD = Strongly Disagree.

9.2 Survey

Nature-Human relationship

Start of Block: Demographics

Q1 **Dear Participant,**

[Voor Nederlands, klik op de knop rechts boven]

My name is Isabel Samuilova. You are being invited to participate in a research study as part of my Master's thesis in the field of Environmental Management from the Faculty of Behavioural, Management and Social Sciences at the University of Twente.

The research aims to better understand how people's attitudes and actions in their private gardens contribute to urban sustainability and biodiversity conservation.

If you are over 18, a resident of Leeuwarden and you live a house with a garden, your participation is much appreciated.

Estimated time to complete this questionnaire: Approximately **7-10 minutes**.

Ethical Consideration: Responses to this questionnaire will help to improve urban sustainability policies. The questionnaire starts by asking for some personal details, such as age, gender, educational level, etc. However, I would like to assure you that all data gathered will only be used for this research. Your information will be completely anonymized, adhering to all G.D.P.R. regulations. Your individual responses will not be given to any third party whatsoever. In addition, you will not be added to any mailing lists as a result of taking this survey. Participation in this study is entirely voluntary and you can withdraw anytime.

For any questions, comments or complaints please feel free to reach out to me, Isabel **Samuilova**, at: i.v.samuilova@student.utwente.nl.

I am very grateful for your time and participation!

Page Break

Q2 In this section, you will be asked to answer some demographic questions.

Q3 Do you live in Leeuwarden, older than 18 and you live in a house with a garden (rented or owned)?

- ○ No - to one or all of the questions above
- ○ Yes - to all of the questions above

Skip To: End of Survey If Do you live in Leeuwarden, older than 18 and you live in a house with a garden (rented or owned)? = No - to one or all of the questions above

Q4 Do you own the house you live in or do you rent it?

- ○ Rent
- ○ I'm the owner

Q5 What is your postcode?

_____

Q6 What is your gender?

- ○ Male
- ○ Female
- ○ Other

Q7 What is your age?

- ○ 18 - 29
- ○ 30 - 45
- ○ 46 - 67
- ○ 68 - 80
- ○ 81 or older

Q8 What is your highest obtained educational level?

- ○ Elementary school
- ○ High school graduate (VMBO, HAVO, VWO)
- ○ Secondary Vocational education (MBO)
- ○ Higher vocational education (HBO)
- ○ University (WO)

Q9 Please indicate your bruto annual household income:

- ○ Less then €20,000
- ○ €20,000 - €39,999
- ○ €40,000 - €59,999
- ○ €60,000 - €79,999
- ○ €80,000 - €99,999
- ○ More than €100,000
- ○ Prefer not to say

Q10 Are you born in the Netherlands?

- ○ No
- ○ Yes

Display This Question:

If Are you born in the Netherlands? = Yes

Q11 Where are your parents born?

- ○ Two parents born in the Netherlands
- ○ One parent born in the Netherlands, one abroad
- ○ Two parents born abroad

End of Block: Demographics

Start of Block: Individuals' worldviews

Q12 Listed below are 15 statements about the relationship between humans and the environment. For each one, please indicate whether you (mainly) agree, unsure, or (mainly) disagree.

	(mostly) Agree (1)	Unsure (2)	(mostly) Disagree (6)
1. We are approaching the limit of the number of people the earth can support (1)	○	○	○
2. Humans have the right to modify the natural environment to suit their needs (2)	○	○	○
3. When humans interfere with nature, it often produces disastrous consequences (3)	○	○	○
4. Human creativity will ensure we keep the Earth livable (4)	○	○	○
5. Humans are severely abusing the environment (5)	○	○	○
6. The earth has plenty of natural resources if we just learn how to develop them (6)	○	○	○
7. Plants and animals have as much rights as humans to exist (7)	○	○	○
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations (8)	○	○	○
9. Despite our special abilities, humans are still subject to the laws of nature (9)	○	○	○
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated (10)	○	○	○
11. The earth is like a spaceship with very limited room and resources (11)	○	○	○
12. Humans were meant to rule over the rest of nature (12)	○	○	○

13. The balance of nature is very delicate and easily upset (13)	○	○	○
14. Humans will eventually learn enough about how nature works to be able to control it (14)	○	○	○
15. If things continue on their present course, we will soon experience a major ecological catastrophe (15)	○	○	○

End of Block: Individuals' worldviews

Start of Block: Willingness

Q13 How important is it for you to live close to a green environment?

- ○ Extremely important
- ○ Very important
- ○ Moderately important
- ○ Slightly important
- ○ Not at all important

Q14 How would you describe the activity of observing nature, indoors or outdoors? Think for example about activities such as listening to birds or observing changes in plants' growth.

- ○ I find it extremely enjoyable
- ○ I find it somewhat enjoyable
- ○ I don't find it enjoyable at all

Q15 Which of the following pictures do you find the most attractive for a garden/outside space?

- ○ Modern garden
- ○ English cottage garden
- ○ Wild garden

Q16 For each parameter, please choose what would be the answer for your **ideal** garden.

	0% (1)	25% (2)	50% (3)	75% (4)	100% (5)
1. Ideally, I would like to have __% of my garden covered with plants and/or trees (2)	○	○	○	○	○
2. I'm willing to increase the biodiversity in my garden by planting a big variety of plants (trees, shrubs and low level plants such as flowers and herbs). Choose between (1 - 5). 5 being high variance (3)	○	○	○	○	○
3. I'm willing to plant mainly native species to support local biodiversity. Choose between (1 - 5) (4)	○	○	○	○	○

End of Block: Willingness

Start of Block: Action

Q17 Now, for each parameter, please choose the degree that represents your **current garden**.

	0% (1)	25% (2)	50% (3)	75% (4)	100% (5)
1. __% of my garden is currently covered with plants and/or trees (2)	○	○	○	○	○
2. My garden has a big variety of plants (trees, shrubs, low level plants such as flowers and herbs) Choose between (1 - 5). 5 being high variance (3)	○	○	○	○	○
3. My garden has mainly native species to support local biodiversity. Choose between (1 - 5). (4)	○	○	○	○	○

Q18 What are the reasons that you chose for a garden with less than 50% plants? Please choose 4 answers.

- [ ] I don't like doing gardening
- [ ] Maintaining a green garden costs too much money
- [ ] Garden tiles are more practical
- [ ] It costs too much time to maintain
- [ ] I don't like having plants in my garden
- [ ] I like nature, but not in my own garden
- [ ] A green garden is physically too hard for me to maintain
- [ ] Most of my neighbors have a garden with a lot of pavement
- [ ] More tiles make my garden look more organized and representative
- [ ] It's the responsibility of the municipality to make sure that the city is green
- [ ] There is too much choice and I don't know how to make my garden green
- [ ] I don't want to have weeds in my garden. Having more garden tiles prevents weeds from growing
- [ ] Other _____

Carry Forward Selected Choices from "What are the reasons that you chose for a garden with less than 50% plants? Please choose 4 answers."

Q19 Please rank your answers. You can do that by re-ordering the statements. The most important reason for you should be in the top, and the least important reason should be at the bottom.

_____ I don't like doing gardening
_____ Maintaining a green garden costs too much money
_____ Garden tiles are more practical
_____ It costs too much time to maintain
_____ I don't like having plants in my garden
_____ I like nature, but not in my own garden
_____ A green garden is physically too hard for me to maintain
_____ Most of my neighbors have a garden with a lot of pavement
_____ More tiles make my garden look more organized and representative
_____ It's the responsibility of the municipality to make sure that the city is green
_____ There is too much choice and I don't know how to make my garden green
_____ I don't want to have weeds in my garden. Having more garden tiles prevents weeds from growing
_____ Other

Q20 What are the reasons that you chose for a garden with 50% - 100% covered with plants? Please choose 4 answers.

- [ ] I like to do gardening
- [ ] I don't think it takes too much time
- [ ] I find a green garden to be prettier
- [ ] I know biodiversity is declining and I want to support it
- [ ] Having a green garden increases the value of my property
- [ ] I want to learn more about plants and gardening helps me learn
- [ ] Most of my neighbors have a green garden and it motivated me to
- [ ] My house already had a green garden when I bought it and I intend to keep it that way
- [ ] I want to make my garden more climate-resistant (more shade against heat-waves and better rain-absorbtion)
- [ ] Other _____

Carry Forward Selected Choices from "What are the reasons that you chose for a garden with 50% - 100% covered with plants? Please choose 4 answers."

Q21 Please rank your answers. You can do that by re-ordering the statements. The most important reason should be at the top, awhile the least important reason should be the last.

_____ I like to do gardening
_____ I don't think it takes too much time
_____ I find a green garden to be prettier
_____ I know biodiversity is declining and I want to support it
_____ Having a green garden increases the value of my property
_____ I want to learn more about plants and gardening helps me learn
_____ Most of my neighbors have a green garden and it motivated me to
_____ My house already had a green garden when I bought it and I intend to keep it that way
_____ I want to make my garden more climate-resistant (more shade against heat-waves and better rain-absorbtion)
_____ Other

End of Block: Action

Start of Block: Policy

Q22 Just 2 more questions!

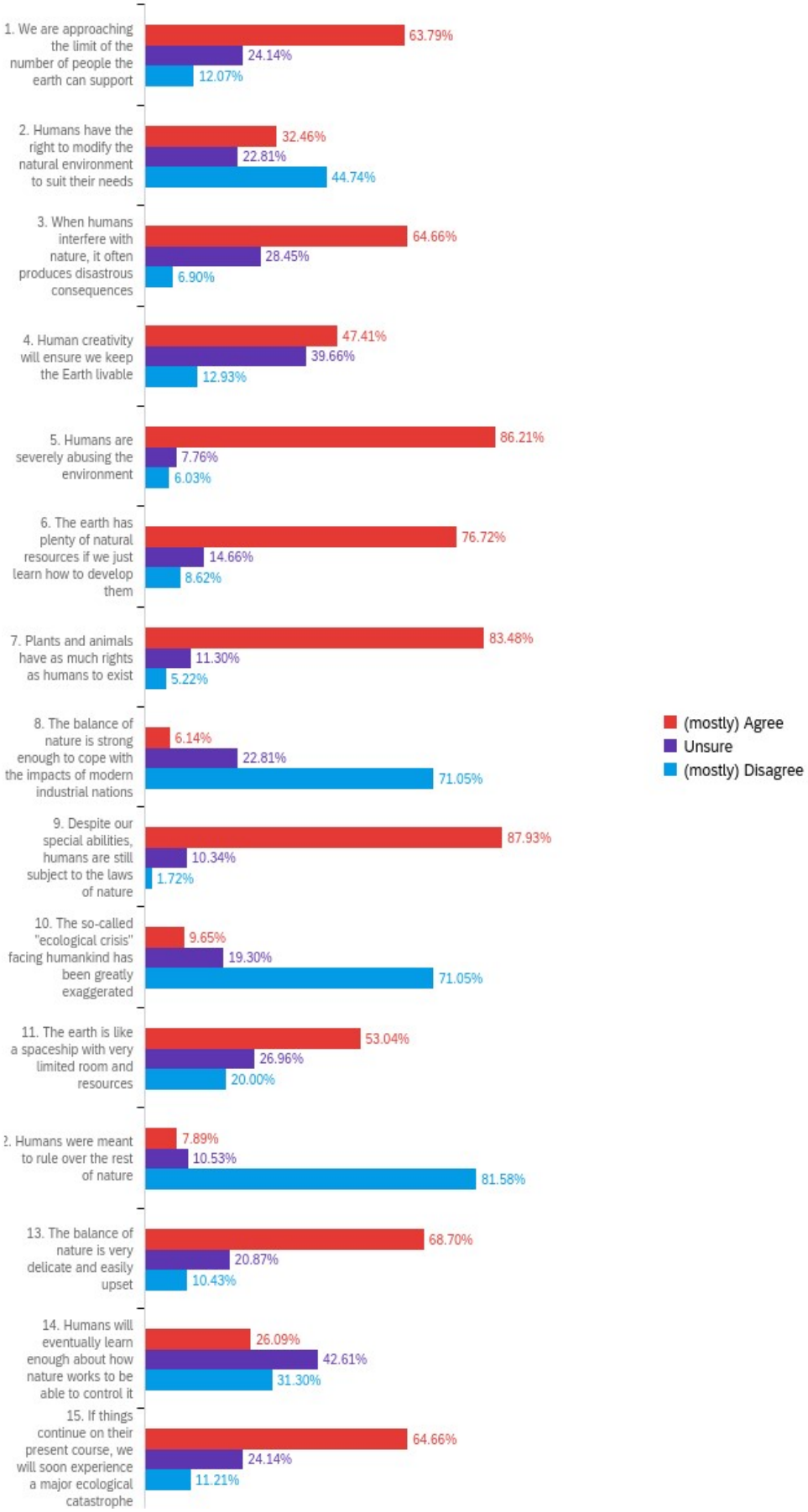
Q23 Did you know that the municipality has subsidies for making gardens more sustainable?

- ○ No
- ○ Yes

Q24 How can the municipality motivate you to make your garden greener? Multiple answers are possible.

- [ ] By organizing information evenings, where residents are informed about taking steps towards sustainability and greening practices
- [ ] By providing more subsidies
- [ ] By providing free access to gardening coaches
- [ ] By organizing events, such as competitions between neighborhoods
- [ ] By giving residents with less garden pavement discounts on sewage tax
- [ ] By giving a fine based on m2 of pavement (pavement tax)
- [ ] Other, please explain _____

End of Block: Policy


1. We are approaching the limit of the number of people the earth can support
63.79%
24.14%
12.07%
2. Humans have the right to modify the natural environment to suit their needs
32.46%
22.81%
44.74%
3. When humans interfere with nature, it often produces disastrous consequences
64.66%
28.45%
6.90%
4. Human creativity will ensure we keep the Earth livable
47.41%
39.66%
12.93%
5. Humans are severely abusing the environment
86.21%
7.76%
6.03%
6. The earth has plenty of natural resources if we just learn how to develop them
76.72%
14.66%
8.62%
7. Plants and animals have as much rights as humans to exist
83.48%
11.30%
5.22%
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations
6.14%
22.81%
71.05%
9. Despite our special abilities, humans are still subject to the laws of nature
87.93%
10.34%
1.72%
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated
9.65%
19.30%
71.05%
11. The earth is like a spaceship with very limited room and resources
53.04%
26.96%
20.00%
2. Humans were meant to rule over the rest of nature
7.89%
10.53%
81.58%
13. The balance of nature is very delicate and easily upset
68.70%
20.87%
10.43%
14. Humans will eventually learn enough about how nature works to be able to control it
26.09%
42.61%
31.30%
15. If things continue on their present course, we will soon experience a major ecological catastrophe
64.66%
24.14%
11.21%
(mostly) Agree
Unsure
(mostly) Disagree

9.3 Interview questions

Tijd:

Datum:

Plaats:

Duur van het gesprek:

Positie van de geïnterviewde:

Introductie:

- Introductie Isabel
- Uitleg van het interview –› doel onderzoek, gebruik van de data & duur van het interview.
- Toestemmingsformulier
- Eventuele vragen beantwoorden voordat het interview begint

1. **Vragen over de functie**
    a. Kunt u aangeven wat uw functie inhoudt?
    b. Bent u verantwoordelijk voor een specifieke regio binnen Leeuwarden?
    c. Met welke andere partijen zit u meestal aan tafel?

2. **Vragen over het huidige duurzaamheidsbeleid en -plan van de gemeente**
    a. Kunt u aangeven op welke acties de gemeente zich het meest richt?
    b. Wat heeft geleid tot de totstandkoming van dit plan?
    c. Hoe ver is Leeuwarden met de implementatie?
    d. Wat zijn de grootste uitdagingen?
    e. Wat zijn de grootste overwinningen?
    f. Hoe reageren de burgers? Weten ze van deze plannen? Werken ze mee?
    g. 70% van de oppervlakte van de gemeente is in particuliere handen. Het vergroenen van particuliere tuinen is echter zeer kort beschreven. Kunt u uitleggen waarom?

3. **Vragen over huidig gedrag van bewoners**
    a. Kunt u de resultaten van de WK tegelwippen voor Leeuwarden delen? Wat draagt volgens u bij aan de verandering?
    b. Wat zijn volgens u de 3 belangrijkste redenen waarom zo veel bewoners toch voor tegels kiezen?
    c. Ziet u een toename in interesse of bewustwording?
    d. Vergroening blijft vaak een intentie en niet het daadwerkelijke gedrag. Wat is volgens u de reden hiervoor? wat zou kunnen leiden tot daadwerkelijke gedragsverandering?
    e. Hoe zit het met het kennisniveau van huiseigenaren op het gebied van klimaatadaptatie? Wat betekent dit voor deelname?

4. **Toekomstige acties**
    a. Heb je overwogen om met tuincoaches te werken?

b. Werkt Leeuwarden samen met andere gemeenten om van elkaar te leren?
c. Als er nog steeds niets verandert, welke andere maatregelen overweegt u dan in de toekomst?

Vragen over het afnemen van enquêtes

- Beste manier om huiseigenaren te benaderen.

Afsluiting:

- Vragen of de geïnterviewde denkt alle belangrijke informatie te hebben gegeven of dat hij/zij zelf nog iets heeft toe te voegen.
- Vragen of de geïnterviewde nog andere personen, rapporten of beleidsdocumenten kent die wellicht interessant zijn voor mijn onderzoek.
- Vragen aan de geïnterviewde of het mogelijk is op een later moment via de mail enkele vervolgvragen te stellen indien dat noodzakelijk is voor het onderzoek.
- De geïnterviewde nogmaals bedanken voor hun tijd en medewerking