Pathways towards a sustainable kunuku landscape

Exploring transdisciplinary foresight and ambiguity in Bonaire

Master thesis

Karl Scheifinger

WAGENINGEN UNIVERSITY & RESEARCH

Pathways towards a sustainable kunuku landscape

Exploring transdisciplinary foresight and ambiguity in Bonaire

by
Karl Scheifinger

in fulfilment of the requirements for the degree of
Master of Science in Environmental Sciences
at
Wageningen University & Research
Environmental Policy group

Student number: 1048936
Project duration: November 2021 until June 2022

Thesis committee
supervisor: Dr. Kasper Kok, kasper.kok@wur.nl
examiner: Dr. Eira Carballo Cárdenas, eira.carballocardenas@wur.nl

Description of front image
Dirt road in the kunuku landscape surrounding Rincon, Bonaire. Credits: author

Disclaimer
This report is produced by a student of Wageningen University and Research (WUR) at the chair group of Environmental System Analysis, in partial fulfilment of the degree of Master of Science in Environmental Sciences. It does not represent any formal opinion nor statement of the WUR.
Copyright © June 2022. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, without the prior consent of the author.

Summary

Imagination is understood as a vital element of transformations towards sustainable human societies. This study explores scientific foresights and their relationship to ambiguity in the context of the kunuku landscape on Bonaire.
This research constitutes out of four research activities. Firstly, six objects of ambiguity as well as four subjects with converging stakeholder frames were identified through a thematic analysis. Secondly, a stakeholder-driven stakeholder categorisation was conducted to portray the societal network connected to the kunuku landscape. Subsequently, three pathways – consisting out of 58 specific actions – towards a sustainable kunuku landscape in 2050 were co-created within a participatory backcast. Lastly, a novel analytical framework for foresight processes was applied to scrutinise the backcasting and its preceding visioning process. Based on its findings, this study concludes by recommending a pluralistic, 'opening-up' approach towards anticipatory governance and by supporting calls for theory-backed, transdisciplinary foresight processes.

Imagining
a future
is the first
step to make it
reality.

Table of Contents

Introduction **4**
Research objectives and questions **5**
Scope 6
Conceptual Framework **7**
Ambiguity & Thematic analysis 7
Ambiguity – capturing social confusion 7
Thematic analysis – assessing converging & diverging frames 9
Anticipatory governance & foresights 9
Anticipating the future 9
Towards an extended framework for the analysis of foresight processes 10
Scenario development 11
Engaging with the future 11
Backcasting - Pathways towards a normative future 12
Stakeholder engagement 13
How, who and for which purpose? 13
Co-production of knowledge 13
Taking the first step – Identification of stakeholders 14
Research methods **15**
Research activities 15
RQ. 1.1 – Thematic Analysis 15
RQ 1.2 & 1.3 – Extended analytical framework 15
RQ 2.1 – Stakeholder Categorisation 16
RQ 2.2 – Backcasting Workshop 16
Data sampling 17
Results **18**
RQ 1.1 – Converging and diverging frames 18
Substantive agreement 18
Strategic agreement 19
Substantive ambiguity 19
Strategic ambiguity 21
Institutional ambiguity 22
RQ 1.2 – Analysis of visioning process 24
RQ. 1.3 – Analysis of backcasting process 27
RQ. 2.1 – Important stakeholders 30

Mapping stakeholders 30
Exploring the matrix 31
RQ. 2.2 – Pathways of action 32
Generated items 32
Pathways, strategies and specific actions 32
Responsible actors 36
Participant evaluation 36
Discussion 37
Methods and caveats 37
TA & Ambiguity 37
Extended analytical framework for foresights 38
Backcasting 39
Scenarios 40
Stakeholder engagement 40
Improving foresight processes & anticipatory governance 44
Recommendations & Conclusion 46
References 48
Appendix 53
Item list: semi-structured interview for RQ 1.2 53
Item list: semi-structured interview for RQ 1.1 and RQ 2.1 54
Stakeholder categorisation 55
Specific actions 56

Introduction

This is a time of large environmental crises. Biodiversity is showing the most rapid decline in human history (IPBES, 2019; Secretariat of the Convention on Biological Diversity, 2020), the climate system is undergoing its fastest changes since thousands of years (IPCC, 2021) and globally decreasing environmental quality is threatening the livelihood of humanity (Broman & Robèrt, 2017). To overcome these and other environmental challenges, it is recognised that large-scale societal changes are necessary (Broman & Robèrt, 2017; Mauser et al., 2013). Global treaties, such as the Paris Agreement, symbolise the urgent need for transformation on a global scale (Veland et al., 2018).

Voices inside as well as outside science argue for the critical role of imagination in this transformation. Especially the scientific community engaged in sustainability research is paying rising attention to the imagination and governance of the future (Muiderman et al., 2020). Furthermore, scientists are pointing out the importance of storylines for a successful transformation of society (Hajer & Versteeg, 2019; Veland et al., 2018). Wyborn et al (2020, p.671) openly state that "*imagination is critical to sustainable and just futures for life on Earth*". This opinion is shared with people outside the scientific realm. In her letter imprinted in *The Guardian,* Nemonte Nenquimo (2020) describes the spiritual poverty of the Western world as the root cause for today's environmental problems. Tim Christophersen, head of the Nature for Climate Branch of the UN Environment Program, states that "*The main challenge is the lack of human imagination; our inability to see a different future because we're staring down this dystopian path of pandemic, climate change, biodiversity loss*" (Rose, 2021). Research can contribute crucially to overcome this challenge and to imagine sustainable futures (Wyborn et al., 2020).

One way science can contribute to the imagination of sustainable futures is by creating and participating in foresights, which can be broadly understood as deliberate and systematic interactions with the future. Methods likely to be used in this context are, amongst others, scenarios, visioning and backcasts (Fuerth, 2009; Muiderman et al., 2020; Voros, 2003). Such foresights became a common tool within the realm of sustainability science (Vervoort & Gupta, 2018). While the focus in foresights is often put on the output – e.g. predictions, visions and pathways - increased scientific attention is paid to the process. Vervoort et al. (2015) even argue that it is the foresight process, and not the output, that is most important to provoke and motivate the imagination of radically different futures.

There are at least three arguments that support this statement. Firstly, it is important to note that the future is never imagined unattached to the present. Deeply socially embedded paradigms, assumptions and narratives about the present shape our imagination of the future (Veland et al., 2018; Vervoort et al., 2015). Therefore, the actors and the context in which a foresight process takes place can crucially affect the futures imagined.

Secondly, recent scientific literature shows that the way the future is conceptualised within the foresight process has profound implications on the imaginations and the kind of actions that are sought in the present (Hajer & Versteeg, 2019; Muiderman et al., 2020).

Thirdly, it is within the process of a foresight that a consensus emerges on what are deemed plausible and implausible futures (Ramírez & Selin, 2014). This almost unpreventable demarcation can be a fundamental barrier to the imagination of radically different futures (Vervoort et al., 2015). Despite its importance, foresight processes are so far not well studied and are rarely object of in-depth evaluation (Vervoort & Gupta, 2018). With foresights

gaining momentum within the scientific community, this lack of social science scrutiny is problematic.

For scientific research to play a key role in the creation and imagination of alternative futures, the adoption of transdisciplinary processes, that allow for the participation of non-scientific actors and the incorporation of multiple knowledge systems, is of importance (Hajer & Versteeg, 2019; Pereira et al., 2019; Wyborn et al., 2020). In processes that involve multiple stakeholders, the presence of ambiguity, which describes multiple diverging understandings of the same issue, is inevitable (Brugnach et al., 2011; Brugnach & Ingram, 2012). When ignored, this "simultaneous presence of multiple frames" (Brugnach et al., 2011, p.79) can prevent the shared imagination of a sustainable future, hinder collective action as well as complicate the design of effective solutions (Allain & Salliou, 2022; Brugnach et al., 2011; Brugnach & Ingram, 2012; Giordano et al., 2017). Due to the limited scientific understanding of foresight processes, it does not come as a surprise that the interplay between foresights and present ambiguities is not researched.

A topical case of the application of a transdisciplinary foresight can be found in Bonaire. Local stakeholders and a team of researchers came together in a foresight exercise to create a vision about the island's future. The output of this collaborative vision-making process were tangible, landscape-specific visions for Bonaire in 2050 (Verweij et al., 2020). However, following Verweij et al. (2020) more work has to be done to translate the 2050 vision for Bonaire into concrete measures. This is important because formulating specific steps towards an aspired future might allow imaginations to unfold more of their transformative power. Moreover, despite the importance to scrutinize the process of foresights as well as the ambiguities at play, no research has yet been conducted to address those issues. This research concentrates on the kunuku landscape, one of the multiple landscapes described by Verweij et al. (2020). Foresight activities related to the kunuku landscape on Bonaire are summarised under the term "kunuku foresight".

Research objectives and questions

Aiming to have theoretical as well as applied relevance, this thesis has two research objectives. The first (theoretical) objective is to contribute to the social-scientific understanding of foresights by analysing the kunuku foresight and assessing its handling of prevailing ambiguities. To do so, the analytical framework for foresights presented by Muiderman et al. (2022) is extended to incorporate the interplay between foresights and present ambiguities. The second (applied) research objective is to help to achieve the 2050 vision of the kunuku landscape by co-creating pathways towards it.
To reach the objectives stated above, this research aims to answer the following two general research questions (RQ) and their corresponding sub-research questions:

1. **What constitutes the kunuku foresight process?**
   1.1 What are current prevailing ambiguities regarding the kunuku landscape?
   1.2 What constitutes the kunuku visioning process?
   1.3 What constitutes the kunuku backcasting process?
2. **To what extent can foresight contribute to achieving the 2050 kunuku vision?**
   2.1 Who are important stakeholders regarding the kunuku landscape?
   2.2 What are co-created pathways to achieve the 2050 kunuku vision?

Figure 1 depicts how the kunuku foresight is understood in this research. The overall foresight consists of two separate parts: a visioning and a backcasting exercise. While the visioning was already conducted by Verweij et al. (2020), the backcasting is conducted within this study to design pathways to achieve the 2050 kunuku vision. Within RQ 1, the processes of both foresights are assessed in this thesis.

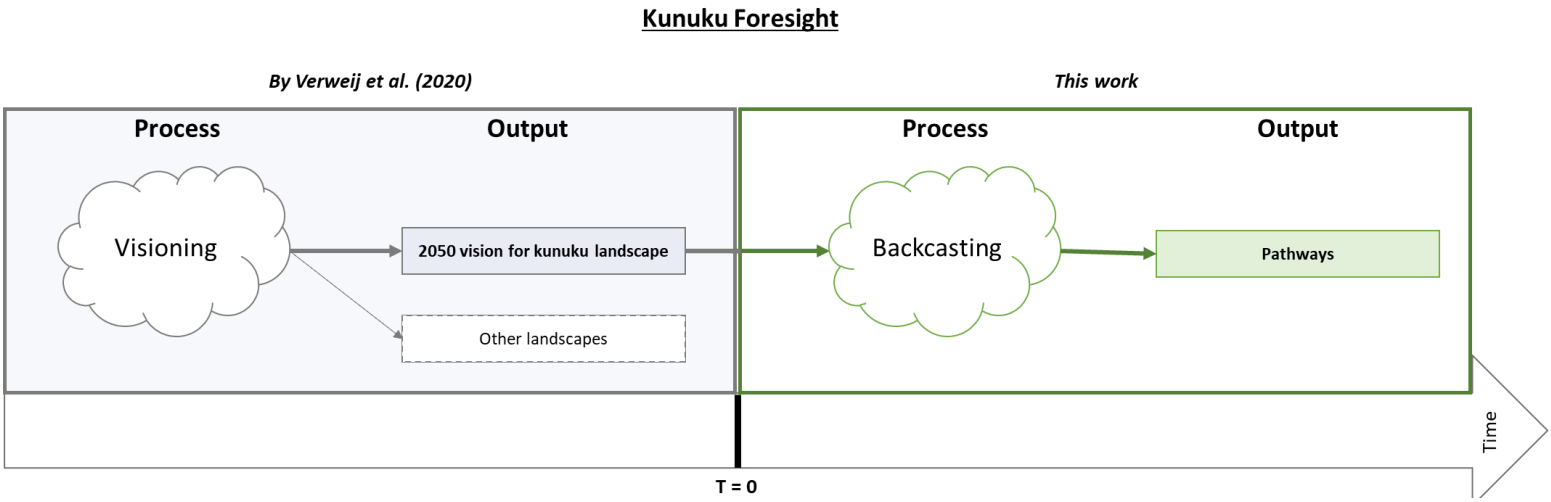

Figure 1: The kunuku foresight, consisting of the visioning by Verweij et al. (2020) and the backcasting conducted in this study.

Scope

Bonaire is a special municipality of the Netherlands located in the Caribbean. The island is facing a variety of challenges, including societal problems, such as mass tourism and population growth, as well as environmental problems, ranging from loss and degradation of nature areas and soil erosion to invasive species and climate change. The common future vision, which explicitly puts a focus on increasing the environmental quality on the island, is meant to address to challenges in a nature-inclusive manner (Verweij et al., 2020).
In order to narrow the scope of this research, the focus of this thesis is put on the kunuku landscape of Bonaire. Landscapes are considered an appropriate scale to foster sustainable development (Allain & Salliou, 2022).
"Kunuku" is Papiamento and means farm. The historic land use of the kunuku area was agriculture (Verweij et al., 2020). Recent research shows that urbanisation left large parts of the culturally important kunuku landscape abandoned. The estimated area of cultivated land decreased by 76% from 1952 to 2019 (Lazebnik et al., 2022). To counteract the current dependence on food imports – 99% of all food is imported to the island (Verweij et al., 2020) – the local government committed itself in its latest board programme to foster local food production (Board of Directors Bonaire, 2019). Therefore, the kunuku landscape could play an important role in the future of Bonaire.

Figure 2 displays two maps of Bonaire. The map to the left displays the landscapes delineated by Verweij et al. (2020). The map to the right shows the official spatial plan of Bonaire (Openbaar Lichaam Bonaire, n.d.). Following comments from stakeholders, this research extends its understanding of the kunuku landscape from Verweij et al. (2020) to all area designated to agriculture according to the spatial plan. The major difference is that thereby the area around Rincon is also understood as part of the kunuku landscape.

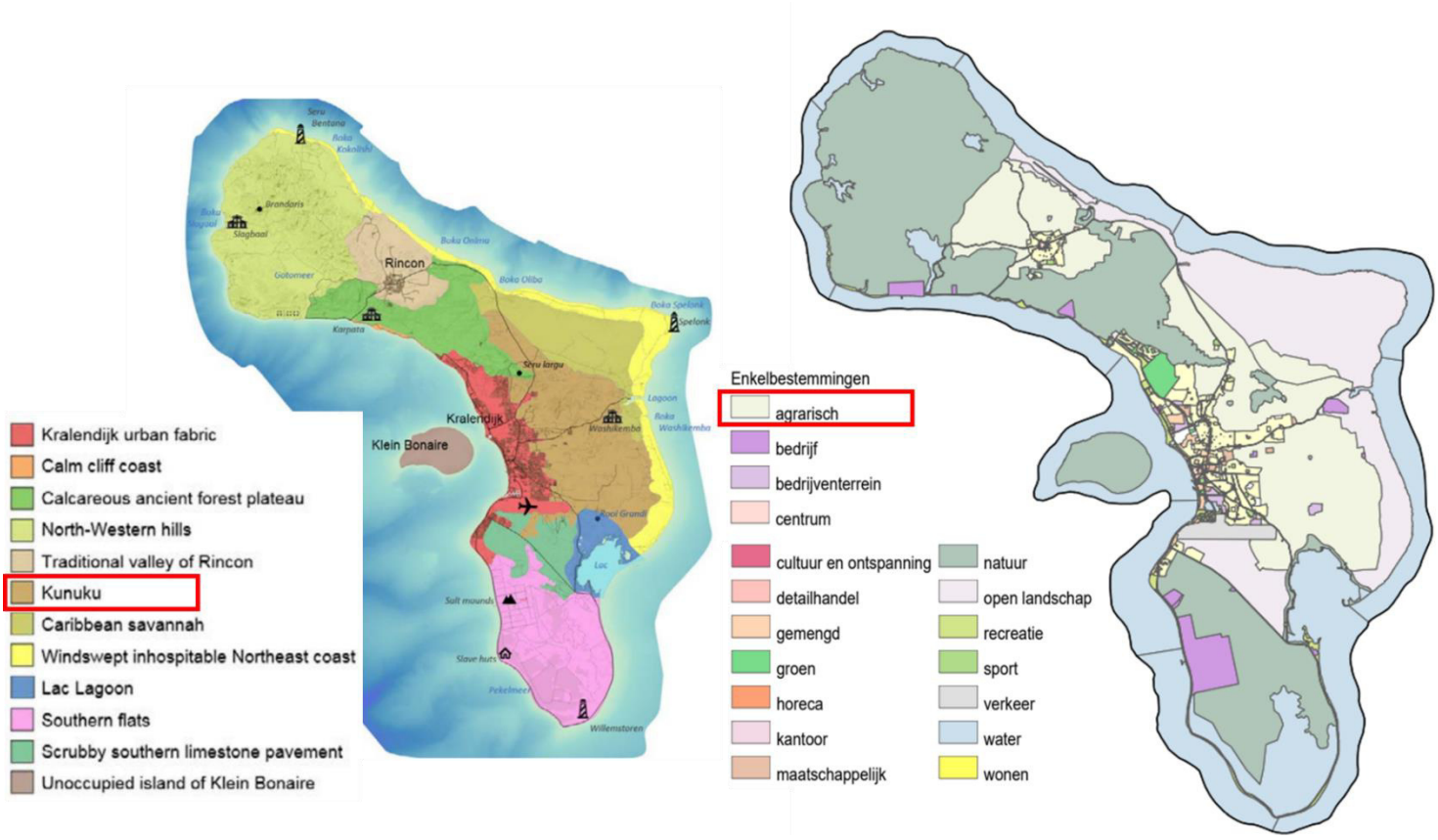

Figure 2: The kunuku landscape on Bonaire. Left: Bonairean landscapes according to Verweij et al. (2020). Right: Bonaire's official spatial plan; Source: (Openbaar Lichaam Bonaire, n.d.). *The red squares indicate where the legend of the respective map refers to the kunuku landscape.*

Conceptual Framework

The key concepts identified in the research questions are ambiguity, foresight, scenario development and stakeholder engagement. This chapter discusses how wider scientific literature approaches those concepts and defines the perspectives taken within this research.

Ambiguity & Thematic analysis

Ambiguity – capturing social confusion

Ambiguity arises when realities clash (Parviainen et al., 2019). The term describes the state of social confusion that emerges when differences in interests, values and believes accumulate in diverging understandings of a system (Brugnach et al., 2011; Giordano et al., 2017). It is crucial to distinguish between disagreement about the problem (ambiguity) and disagreement about values. Caused by the subjective nature of knowledge, ambiguity, which is also referred to as technical incommensurability (Allain & Salliou, 2022), stems from the differences in understanding and knowing reality (Best, 2008; Parviainen et al., 2019). Social incommensurability, on the other hand, refers to a difference of values and preferences (Allain & Salliou, 2022). Under the presence of ambiguity, for example, actors might differ in their frames whether water scarcity is caused by a water supply or water demand (Dewulf & Biesbroek, 2018). In contrast, in the case of social incommensurability, actors can agree on water supply as being the main problem, but, based of a difference in valuing environmental and economic aspects, disagree on whether water pumps should be powered by electricity or cheaper natural gas.

From a neutral perspective, ambiguity can be seen as an inevitable feature of human interaction. On the one hand, ambiguities can create space for innovation and creative solutions (Giordano et al., 2017). On the other hand, ambiguities can cause conflicts, prevent a shared problem understanding, thereby undermining efforts to draft effective and legitimate solutions, and harden cooperation (Brugnach et al., 2011; Dewulf & Biesbroek, 2018; Giordano et al., 2017; Parviainen et al., 2019). Giordano et al. (2017) even conclude that ambiguity, when completely unaddressed, can be a major barrier to taking collective action. Therefore, formalising ambiguities can be an important stepping stone in finding a shared language, creating a common problem understanding and eventually supporting social learning (Giordano et al., 2017). Moreover, integrating different forms of knowledge can enhance the efficiency and legitimacy of governance as well as foster commitment to policies (Parviainen et al., 2019). In the context of a time where global collaboration is needed to address pressing environmental problems, identifying and overcoming ambiguities is understood as crucial to achieve a transformation towards sustainable societies (Parviainen et al., 2019).

The concept of ambiguity can be operationalised in multiple ways. Dewulf & Biesbroek (2018) and Brugnach et al. (2011) each present several strategies of dealing with ambiguities. Dewulf & Biesbroek (2018) furthermore distinguish between three objects of ambiguity. In this sense, ambiguity can occur as substantive, strategic and institutional, depending on the subject on which frames misalign. Substantive ambiguity persists when a concise problem definition is missing. Strategic ambiguity occurs when actions of actors are understood in different ways. Finally, institutional ambiguity arises when diverging understandings of the meaning of rules exist (Dewulf & Biesbroek, 2018). Allain & Salliou (2022) chose a different, indirect approach towards ambiguity. In their work, they assess the extent to which participatory processes address ambiguities through the degree to which these processes allow for collective deliberation. Based on Dryzek et al. (2003), they describe collective deliberation as activities that make different framings legible and foster constructive debate. In this sense, collective deliberation can crucially contribute to mitigating ambiguity by taking on four different roles. The first role informational. A process fulfils its informational role when participants are confronted with new information. The second role is argumentative. This role is fulfilled when hidden assumptions surface and participant get to directly discuss controversies. The third role is reflective, which entails pushing people towards reflecting and questioning their own premisses and preferences. Lastly, the fourth role through which participatory processes can use collective deliberation to address ambiguity is social. Fulfilling this role can be ensured by allowing participants to interact with each other. Using a process' contribution to collective deliberation as a proxy for assessing it is addressing ambiguities resonates with Brugnach & Ingram's (2012) finding that knowledge production processes need to integrate different frames to appropriately deal with ambiguities.
This study defines ambiguity as "*simultaneous presence of multiple frames of reference about the phenomenon of interest*" (Dewulf & Biesbroek, 2018, p.445), whereby a frame is a subjective layer of understanding which adds meaning to reality (Brugnach et al., 2011). Therefore, diverging frames about the same issue are understood as revealing the presence of ambiguity.

Thematic analysis – assessing converging & diverging frames

In order to identify prevailing ambiguities related to the kunuku landscape, a thematic analysis (TA) is conducted. According to Braun et al. (2019), 'thematic analysis' summarises a variety of approaches to identify themes within qualitative data. This thesis follows a reflexive understanding of TA, in which the researcher acts as a storyteller who attempts to recognise "patterned meaning across the dataset" (Braun et al., 2019, p.848). In this sense, TA is a flexible tool that can be applied in divers contexts to analyse texts (Braun & Clarke, 2006), which makes it suitable to identify converging and diverging frames of understanding. While ambiguity is characterized by diverging frames, this analysis also pursues the identification of converging frames. Keeping in mind that you are likely to find what you are looking for, this is done to reduce the bias of the research towards ambiguities. However, it is also flexibility of a TA that forces researchers to be transparent about the explicit process of analysis as well as assumptions and objectives attached to the analysis. This is of utmost importance since identified themes don't emerge from the dataset, but are actively created by the scientist (Braun & Clarke, 2006).

In their paper, Braun & Clarke (2006) list a set of questions that need to be addressed explicitly to ensure scientific validity of a TA. With respect to the TA conducted in this research, those questions are answered as follows: A theme is defined as a pattern of shared meaning that can either indicate converging or diverging frames of understanding and consists of codes from at least two interviewees. The objective of the TA is a rich description of the qualitative dataset to present the most important themes. Because the TA is conducted to answer a specific research question and therefore focuses on converging and diverging ways of understanding, this study follows a theoretical approach towards TA. Lastly, following an essentialist epistemology, the TA is centred around semantic themes. This means, that themes are identified on the basis of spoken words. The underlying social constructs are not assessed.

The procedure of the TA is based on work from Frith & Gleeson (2004).

Anticipatory governance & foresights

Anticipating the future

To fully grasp the concept of foresight, understanding the notion of anticipatory governance is key. Anticipatory governance is a rather new term, rooted in the scientific discipline of science and technology studies (STS) (Guston, 2014). Muiderman et al. (2022, p.1) widen the understanding of the concept and define anticipatory governance as "*governance processes in the present that seek to use anticipation to engage with uncertain futures in order to guide action in the present*". It is this definition of anticipatory governance that is applied in this research.

In the context of anticipatory governance, the term 'foresight' describes approaches to anticipate the future (Muiderman et al., 2022). The concept of foresight more generally has its roots in the realm of management science (Habegger, 2010) and despite the concept's increased use, it remains a rather intangible term (Major et al., 2001). Therefore, many different understandings of the concept of 'foresight' exist. A holistic understanding of the term is provided by R.A. Slaughter (cited by Major et al., 2001, p.93), who defines foresights as attempts to "*broaden the perception*" of the future. This resonates with Guston (2014) who describes foresights as a divers set of approaches to interact with the future.

Next to that, and more closely related to the realm of management science and strategy

development, foresights can be can be understood as central aspect and core competence of strategic thinking, which is concerned about the development and imagination of multiple futures (Habegger, 2010; Major et al., 2001; Voros, 2003). Others again consider foresight rather as an instrument that allows to envision different futures and estimate their consequences (Fuerth, 2009). Following Slaughters broad, approach-based understanding of 'foresight' presented by Major et al. (2001), this research understands foresight as a deliberate and systematic interaction with the future.

Towards an extended framework for the analysis of foresight processes

There is not only a diverse understanding of the definition of 'foresight' itself, but also of the process of foresights. Habegger (2010), based on a strategic take, captures the foresight process in three phases: the detection of information, generation of foresight knowledge and development of policy options. Voros (2003), on the other hand, provides a framework that describe a foresight process as consisting of the following three activities: analysis, interpretation and prospection.

To gain a deeper, integrated understanding of a foresight process, this work builds on the analytical framework first proposed by Vervoort & Gupta (2018) and then refined by Muiderman et al. (2022). This framework is less focused on identifying different activities within a foresight process, but pays more attention to important features of the process such as objectives, participation and conceptualisation of the future. As depicted in Figure 3, the framework distinguishes between questions related to context in which foresights takes place and questions regarding the process itself. To shed a light on the most relevant characteristics of a foresight process, the framework requires answering six central questions.
Context-related questions target the overall objective for interacting with the future (e.g. risk reduction) and the implications of the foresight results for the present. Following Muiderman et al. (2020), both aspects – overall aim and implications for the present – are closely linked to the conceptualisation of the future within the foresight process. The future can be depicted as probable, plausible, pluralistic and performative, with each category implying certain expectations on the outcome of the foresight. For example, a boundless and pluralistic conceptualisation of the future allows the imagination of radically different futures (ultimate aim), thereby inspiring and motivating societal actors to take action in the present (implication for the present). Next to the conceptualisation of the future, further process-related questions aim to examine the participation as well as the purpose and implementation of applied methods.
Following the notion of Muiderman et al. (2022), anticipatory governance seeks the interaction with the future to direct behaviour in the present. Considering the potential impacts of ambiguity on the human capability to take concerted action in the present and to generate a shared imagination of the future, it is relevant to also assess how foresight processes address present ambiguities. For this purpose, this study extends the analytical framework suggested by Muiderman et al. (2022) to also incorporate ambiguity.

Questions in blue boxes in Figure 3 are taken from Muiderman et al. (2022, p.5). The red box shows additional questions that are meant to elaborate how a foresight process handles ambiguity. As suggested by Allain & Salliou (2022), the contribution of the process to collective deliberation is thereby taken as a proxy for addressing ambiguity.

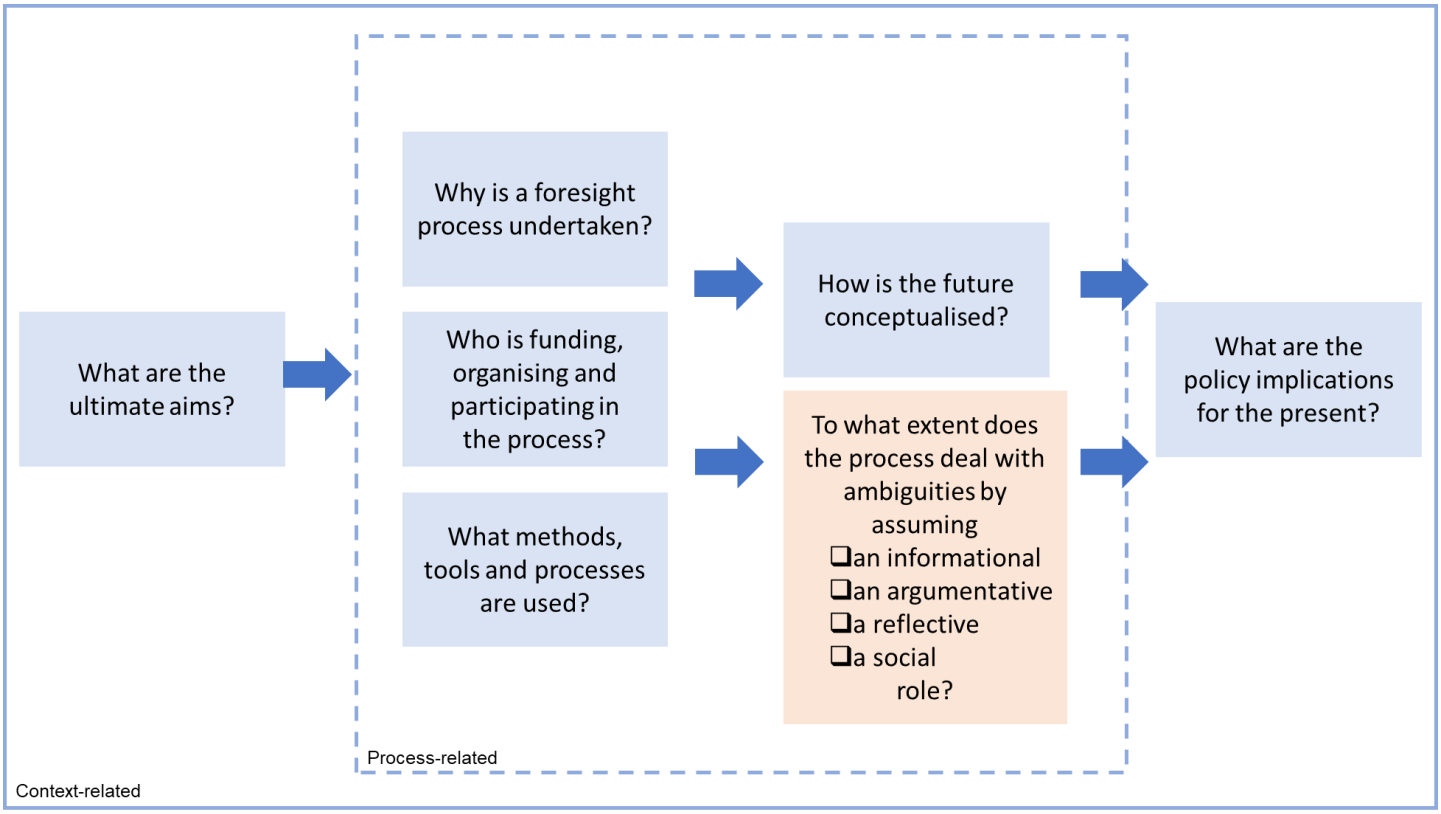

Figure 3: An extended analytical framework for foresight processes.

Scenario development

Engaging with the future

While it was shown above that scientific literature is at largely at odds about the specific meaning of 'foresight', it is widely agreed that scenario development is a prevalent method of conducting foresights (Fuerth, 2009; Major et al., 2001; Muiderman et al., 2020; Voros, 2003). Very broadly, Börjeson et al. (2006, p.723) define scenarios are "*possible future states or developments*". More specific, this work understands scenarios as coherent storylines about the future which can be either narrated in words or numbers (Pereira et al., 2019; Swart et al., 2004). Therefore, scenarios are intrinsically future-oriented.

There are many different types of scenarios. For example, van Notten et al. (2003) categorise scenarios based on their goal, process and content, while Börjeson et al. (2006) focus their typology on different ways of thinking about the future, namely probable, possible and preferable futures. A common point of distinction is the type of data used in a scenario. Qualitative scenarios can incorporate human values, emotions and perspectives while quantitative scenarios rely on computational modelling techniques (Pereira et al., 2019; Swart et al., 2004; van Notten et al., 2003). Another categorisation differentiates between predictive, explorative and normative scenarios (Börjeson et al., 2006). On the one hand, predictive scenarios, that attempt to outline probable futures, as well as explorative

approaches, which focus on describing possible futures, aim for an objective study of the future. Therefore these two approaches are also labelled as descriptive scenarios (Swart et al., 2004; van Notten et al., 2003). Normative scenarios, on the other hand, concentrate on subjective preferable futures (Börjeson et al., 2006; Pereira et al., 2019; Swart et al., 2004; van Notten et al., 2003). For a detailed framework on categorising scenarios consult van Notten et al. (2003). Börjeson et al. (2006) provide a good overview over further scenario typologies.

It has been argued that scenarios can play a crucial role in science's contribution to a transition towards a sustainable society because they allow to bridge different disciplines and ways of knowing, to acknowledge uncertainties regarding the future and to scrutinise different futures and their implications on the present (Swart et al., 2004). As many scientific methods, scenarios thereby benefit from the inclusion of multiple voices from in- and outside the scientific realm. Proponents of more participatory scenario building argue that stakeholder engagement is crucial to ensure the representation of multiple perspectives on complex issues; to appropriately deal with looming uncertainty by including multiple types of knowledge; to ensure that scenarios created are perceived as legitimate and to foster social learning (Pereira et al., 2019). Moreover, Habegger (2010) stated that foresights in general can crucially benefit from stakeholder engagement.

Backcasting - Pathways towards a normative future

The scenario development pursued in this research has a strong qualitative and normative character. The 2050 vision for the kunuku landscape symbolises an explicitly preferred future. Backcasting is suited for sustainability issues in a normative context (Vergragt & Quist, 2011) and a good scenario-type to strategically derive pathways for achieving a certain future (de Bruin et al., 2017). Following Hölscher et al. (n.d.), this research defines pathways as one or multiple strategies that address a certain aspect of a vision. In turn, each strategy is made up by multiple actions. Consequently, in an attempt to create pathways, backcasting is occupied with designing actions.

In contrast to forecasting, backcasting takes the aspired future state as point of reference and then looks backwards from the future to the present (Vergragt & Quist, 2011). Thereby, backcasting generally consists out of two phases: the creation of a vision and the description of means to reach this vision (Gomi et al., 2011). Because this research builds on the visions created by Verweij et al. (2020), the focus of the backcasting conducted within this study is put on creating specific actions that are related to achieving the 2050 kunuku vision.

Participatory backcasting is an appropriate approach to combine a high level of engagement with backcasting (de Bruin et al., 2017; Kok et al., 2011, 2014). The participatory backcasting in this research is based on Kok et al. (2011) and the work package 3.3 of the INTEGRAL project focused on participative qualitative backcasting (Kok et al., 2014). Both works follow a five-step procedure to participatory backcasting. Backcasting is especially useful in situations where current trends are not sustainable long into the future and transforming action is needed (Börjeson et al., 2006). By looking at the challenges described by Verweij et al. (2020), it can be argued that this is the case in Bonaire.

Stakeholder engagement

How, who and for which purpose?

The engagement of stakeholders is closely coupled to the concept of transdisciplinary research, which aims to include non-scientific actors next to scientists in the process of knowledge generation (Durham et al., 2014; Mauser et al., 2013). The overarching idea is that stakeholders, that can be any individual or organisation that can influence or can be affected by a certain process (Durham et al., 2014; Reed, 2008), play a role in this process. The concept of stakeholder engagement is increasingly applied in areas of natural resource management (de Bruin et al., 2017), environmental management (Renn, 2006), environmental policy-making (Falconi & Palmer, 2017) and environmental governance (Bulkeley & Mol, 2003).

In order to differentiate between the myriad potential forms of engagement, multiple categorisations have been suggested. In a rather general perspective, Bulkeley & Mol (2003) distinguish between the information-deficit model and the civic model of engagement. While the first restricts the engagement of stakeholder to one-way dissemination of information and knowledge, the second model is linked to enhancing and fostering fundamental democratic values. Based on the purpose of engagement, Durham et al. (2014) propose a categorisation of four levels. Following this approach, engagement can have four different goals which are seen as increasing in intensity of interaction between scientific and non-scientific actors: to inform, to consult, to involve and to collaborate. Falconi & Palmer (2017) suggest a very similar typology, but add a fifth level of engagement: empowerment. Empowerment is understood to be the highest form of engagement, where decision making power is committed to the public. Closely related to the presented understanding of collaborating with stakeholders, Mauser et al. (2013) present a framework for the co-creation of knowledge. This framework makes a distinction between co-design, co-production and co-dissemination. For an overview over other typologies of engagement see (Reed, 2008).

In scientific literature, stakeholder engagement is seen as beneficial for a great variety of reasons. In an often cited paper, Cash et al. (2003) argue that high levels of engagement ensure legitimacy, credibility and relevance of the produced knowledge, thereby increasing the probability that research output leads to real-life action. Bulkeley & Mol (2003) agree by stating that engagement might allow to connect scientific knowledge about environmental problems to behaviour of responsible actors. Overall, two types of reasoning for engagement can be identified: pragmatic and normative (Reed, 2008). Firstly, on the pragmatic side, engagement can lead to an increase of the effectiveness (Newig et al., 2018), the economic efficiency (Bulkeley & Mol, 2003) and the quality (Reed, 2008; Renn, 2006) of a decision making process. Secondly, concerning the normative side, stakeholder engagement is described as fostering social learning (Newig & Fritsch, 2009), which widely benefits a democratic society (Bulkeley & Mol, 2003; Reed, 2008). Moreover, research found empirical evidence for merits of engagement, such as a positive relationship between engagement and the ecological standard of decisions (Newig & Fritsch, 2009).

Co-production of knowledge

Collaboration with stakeholders in research is understood here as a partnership of equals between researchers and stakeholders within the research process. This means that stakeholders can co-determine the direction of the research and are granted room to introduce

their knowledge and perspectives (Durham et al., 2014; Mauser et al., 2013). Collaborative stakeholder engagement can yield benefits for research as well as stakeholders. For research, close cooperation with stakeholders can lead to a more holistic problem understanding and therefore a sounder analysis. Furthermore, the produced research output has a higher probability of yielding societal impact, motivated by enhanced legitimacy of the research itself. For stakeholders, the co-creation of knowledge enables them to stand up for their interests and actively shape the research process, thereby generating a sense of ownership for the generated information (Durham et al., 2014; Mauser et al., 2013).

This work seeks engagement in form of collaboration and is thereby pursuing the co-creation of knowledge. To do so, this works draws from Mauser et al. (2013) who provide a three-step framework for the co-creation of knowledge. Following this understanding, the co-creation process consists of three steps. The first step is the co-design of the research, which aims at creating a shared agreement on the research goals. In the case of this thesis, the research objectives and research questions were not directly influenced by stakeholders. Therefore, no co-design took place. The second step is the co-production of knowledge. While Mauser et al. (2013) focus in this step on the integration of different scientific disciplines, this research takes a more transdisciplinary approach and concentrates on integrating different stakeholder perspectives and values within semi-structured interviews and the backcasting exercise.
The third and final step is the dissemination of the output of the co-creation process. A plain language and presentation of the generated knowledge is thereby crucial to ensure that the research output can diffuse within different societal groups. Therefore, this research aims to consult stakeholders regarding effective result communication and to create an outreach product (a set of posters) at the end of the knowledge production process.

Taking the first step – Identification of stakeholders

An engagement process starts with analysing stakeholders. This can be done in three steps: identification, categorisation and understanding of stakeholders (Durham et al., 2014).
This research conducts the first two steps to categorise stakeholders. A full-scale stakeholder analysis would exceed the time limitations of this study while it would not significantly contribute to answering the posed research questions. Consequently, this research concedes to not fully understand stakeholders and their relationships by not conducting a more comprehensive stakeholder analysis.
According to (Durham et al., 2014), the first step of a stakeholder analysis aims to determine a wide range of people or organisations that have something at stake. In the second step, stakeholders are grouped into categories. Next to structuring stakeholders, this categorisation aims to support a prioritisation of stakeholders for succeeding engagement activities.

Research methods

This chapter describes the research activities and methods that were applied to answer the research questions posed within this Master thesis.

Research activities

In general, three research activities were pursued. The first activity was the conduction of semi-structured interviews. Data for RQ 1.1 and RQ 2.1 was collected within the same interviews. Therefore, those interviews consisted out of two parts. The first part was focused on stakeholder perspectives regarding the kunuku landscape. After a short introduction of the purpose of the interview and the research project, interviewees were asked to elaborate on the characteristics of the kunuku landscape on Bonaire and its importance for the island. Subsequently, interviewees were directly inquired about their personal interest and the extent with which their quality of life depends on the kunuku landscape. This first part was concluded through a problem-oriented set of questions, in which stakeholders were asked to reflect on current problems in the kunuku landscape and Bonaire in general, roots of those problems and solutions envisioned to address those problems. The second part of these interviews centred around identifying and categorising other stakeholders. Interviewees were asked to name, and later to assess those stakeholders on their influence, dependency and expertise regarding the kunuku landscape.
Data to answer RQ 1.2 was also collected within a semi-structured interview. To scrutinize the visioning process, the questions of this second interview were based on the suggestions made by Vervoort & Gupta (2018, p.107).
All interviews ended with an interview evaluation through the interviewee.
The second activity was a workshop to answer RQ 2.2. As a third activity, the participants of this workshop were surveyed to obtain data for RQ 1.2. Within this survey, participants were asked to evaluate the workshop, reflect on how the future was conceptualised within the backcast and indicate potential ways of communicating the workshop results.

RQ. 1.1 – Thematic Analysis

A thematic analysis (TA) was carried out to identify themes that represent converging or diverging frames of understanding. Following Frith & Gleeson (2004), this TA was conducted in three steps. Firstly the transcriptions of all interviews were coded, whereby a code equalled a description of semantic content. Secondly, codes were grouped into categories. In a third step, patterns of shared or diverging meaning were identified within those categories. The three objectives of ambiguity, namely substantive, strategic and institutional ambiguity (Dewulf & Biesbroek, 2018) were applied to categories the resulting themes and to interpret the implications of prevailing ambiguities on present-day policy making.

RQ 1.2 & 1.3 – Extended analytical framework

The two parts of the kunuku foresight were assessed based on different data sources. The reason for this is that the visioning was conducted in the past by Verweij et al. (2020), whereas the backcasting was conducted within this research. Therefore, different types of information were available for the two processes. The analysis for the visioning process relied heavily on a semi-structured interview with Peter Verweij, the leading researcher behind the visions, and a study of the related research report by Verweij et al. (2020).
The assessment of the backcasting process, on the other hand, was based on the analysis of

four data sources. The first data source was the process agenda of the workshop, in which the workshop was planned in detail. Secondly, participant records provided information regarding participation and working groups. Observation notes taken by an external observer described the atmosphere and group dynamics and a participant survey captured stakeholder perspectives and perceptions about the workshop.

RQ 2.1 – Stakeholder Categorisation

To identify stakeholders, a snowball sampling approach was used. As described by Reed et al. (2009), snowball sampling involved asking primarily identified stakeholders to name other stakeholder(s). In a second step, stakeholders were grouped and categorised. Hereby, in the spirit of co-creation, a stakeholder-led categorisation was pursued. This means, that stakeholders categorised other stakeholders (Reed et al., 2009). To facilitate this categorisation, stakeholders were asked to label the stakeholders they named regarding their influence, dependence and expertise related to the kunuku landscape on an ordinal scale (low, medium, high).

To analyse the resulting stakeholder categorisation, a dependency-influence matrix was created. Following Reed et al.'s (2009) description of an interest-influence-based categorisation, this matrix classifies stakeholders as “Key players”, “Context setters”, “Subjects” and “Crowd”, depending on their location in the matrix. “Key players” possess high influence as well as high dependency, making them central actors. “Context setters” feature high levels of influence but low levels of dependency, resulting in little interest about the issue at hand. “Subjects”, on the other hand, are highly dependent, but lack influence to make an impact. Finally, stakeholders within the “Crowd” are considered as being both, rather uninterested and powerless regarding the respective issue. The matrix was refined to also depict the expertise of stakeholders regarding the kunuku landscape.

RQ 2.2 – Backcasting Workshop

To derive actions to achieve the 2050 vision of the kunuku landscape, a participatory backcasting workshop was conducted. For this exercise, especially participation of stakeholders that are categorised as most affecting and affected by changes in the kunuku landscape was pursued. To ensure a balanced and representative stakeholder selection, the Prospex-CQI method was applied. Following Gramberger et al. (2015), firstly a set of stakeholder criteria was defined. In a second step, a quota was set for each criteria. These quotas, which are oriented at the quotas set by Gramberger et al. (2015) for their CLIMSAVE workshop series, then guided the stakeholder selection for the backcasting workshop.

The objective of the workshop was to ensure that the imagination of the future obtains a performative character by pushing participants towards designing specific actions. Specificity was especially demanded regarding the logic behind an actions (why?) and the actors responsible for its implementation (who?).

To create specific actions, the following four steps were conducted:

1. Presentation of the kunuku 2050 vision
2. Identification of milestones
3. Identification of obstacles and opportunities
4. Design of specific actions

In the first step, three main aspects of 2050 kunuku vision from Verweij et al. (2020) were presented. These three aspects are the creation of touristic and cultural value, agricultural activities that support a self-sufficient Bonaire as well as local water harvesting and energy production. The aspects were aggregated before the workshop from the multiple vision elements presented by Verweij et al. (2020). For each main aspect, a workstation – consisting of a table covered by a poster and sticky-notes – was created. In each of the following steps (steps 2 to 4), participants operated in groups following a carousel procedure in which groups rotate systematically over working stations.
Subsequent to an identification of milestones, which are general targets that need to be accomplished in order to realise the vision, obstacles and opportunities were determined. Obstacles are factors that prevent the achievement of a certain milestone, whereas opportunities enable or facilitate the achievement of a milestone.
In the last step, specific actions were designed. Actions are seen as specific when they are related to milestones, obstacles or opportunities and when actors responsible for their implementation are indicated. Multiple breaks during the workshop gave room for social interaction between participants.

Data sampling

Based on the snowball sampling process described for RQ 2.1, data for RQ 1.1 and RQ 2.1 was collected within 14 interviews, each taking in average one hour. The rate of positive responses was 56%. To ensure an inclusion of the perspectives of local farmers, two of the interviews were conducted with the help of an amateur translator. To answer RQ 1.2 only one interview was conducted. Attempts to organise further interviews with participants of the visioning foresight were unsuccessful (17% positive response rate).Regarding RQ 2.2, nine stakeholders participated in the backcasting workshop. The positive response rate of workshop invitations was 82%. One stakeholder was only able to attend for the first hour. For RQ 1.3, participants of the backcasting workshop were asked to fill out a two-page survey. In total, 9 surveys were filled out. One stakeholder that filled out the survey that was just attending, but not actively participating in the workshop. Figure 4 displays the data sampling procedures of this research over time.

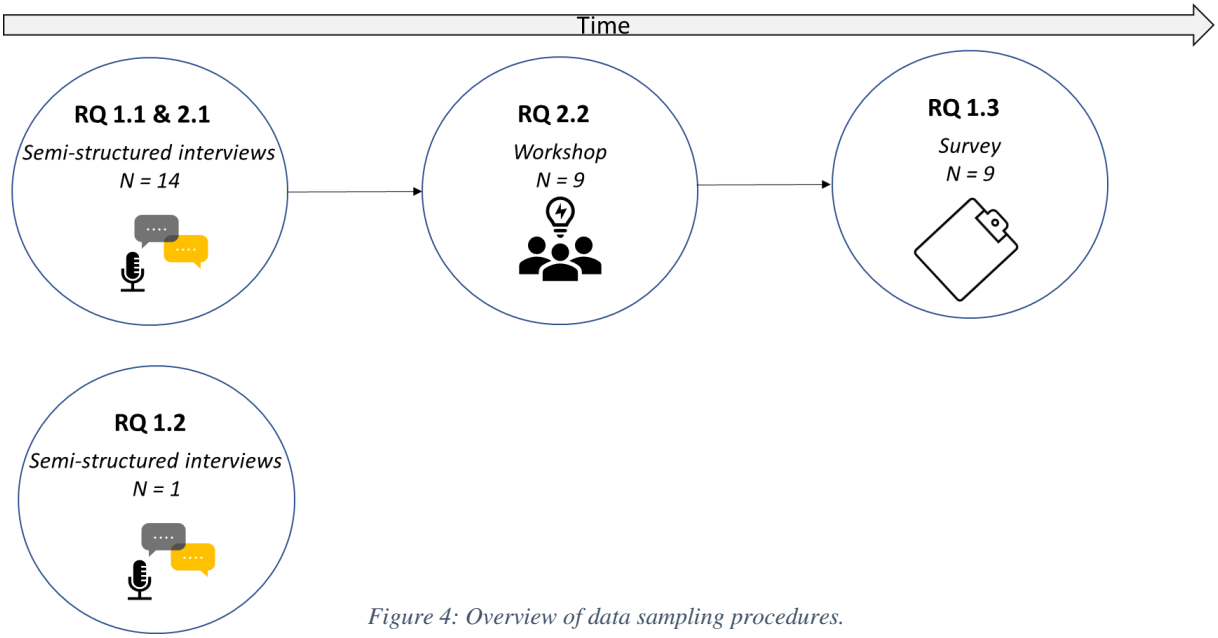

Figure 4: Overview of data sampling procedures.

Results

RQ 1.1 – Converging and diverging frames

RQ 1.1: What are current prevailing ambiguities regarding the kunuku landscape?

After transcribing the 14 interviews, 450 codes were created via the software ATLAS.TI. Subsequently, those codes were categorised into one or multiple of 16 inductively generated code groups. Code groups referred to general aspects such as the economy, agriculture or water. Eventually, codes within code groups were grouped into folders, with a folder collecting codes that address a specific issue (e.g. the state of agriculture on Bonaire, innovative agricultural technologies, etc.). Within those folders, six objects of ambiguity were identified. Next to that, four subjects featuring converging frames were found. The following section describes the identified converging and diverging frames and interprets their policy implications. Anonymised statements from interviewed stakeholders slightly corrected for grammar are presented to support the argumentation.

Substantive agreement

Water is the main bottleneck for agricultural activities

Stakeholders commonly agree that affordable access to water is the most crucial factor to spur agricultural activities of any kind in the kunuku landscape. Interviewee 13: *The biggest problem is water and water and water. So if you have water, you can do more*. Interviewee 9: *[…] one of the biggest problems to produce the land, to put the land in production is water.* Interviewee 10: *[…] because water is our main bottleneck on the island. There's only so much water.*

Therefore, it becomes clear that the price of water and its distribution are very sensitive topics. Because of the centrality of water, policies aiming to mitigate the widespread water scarcity in the kunukus may want to put a strong emphasis on stakeholder engagement.

New approaches towards agriculture are needed

Another uniting frame is the commonly acknowledged need for new approaches towards agriculture. Innovative approaches towards agriculture are not only expected to significantly improve water efficiency and reduce the environmental impact of agricultural systems, but may also help interesting the youth for working in the agricultural sector. Interviewee 10: *But we don't have to grow food with the technologies that were being used thirty years ago. There is room for looking at, okay, what are some of the developments, the newer developments that could help us employ people, help us provide our own sustenance, may growing your own food or whatever and not impact nature that severely.* Interviewee 3: *You could also say, if you want to make agriculture attractive for the future and for new generations, you have to change the image of it and change the direction. So make it more technical. Worldwide, agriculture is nowadays quite technical.* However, some stakeholders note that many modern technologies are very capital intensive and are therefore out of reach for farmers. Interviewee 13: *The problem with this technology is that you need to have capital to do it. And most people, they have the kunuku, but not the capital.*

Overall, this indicates an openness towards new agricultural approaches. Stakeholders are willing to experiment with new technologies and techniques. This circumstance can significantly facilitate the implementation and diffusion of innovations in the field of agriculture.

Dogs are a security problem

A recurrent theme throughout the interviews is that dogs pose a significant problem to kunukeros (Papiamento for 'farmer'). Neglected and underfed by their owners, dogs intrude into kunukus and kill livestock, causing significant economic damage and frustration within the farming community. Interviewee 9: *Big dogs. And they don't stay inside, they jump over the fence, and they go kill the goat and sheep. That happened a lot.* Interviewee 14: *He had 50 sheep, with the problem of dogs now he only has 10.*

This problem is expected to increase with more people living and bringing their dogs into the kunuku landscape. Policies that recognise dogs as a security problem in the kunuku landscape and aiming to effectively reduce the number of intrusions are expected to receive widespread support.

Strategic agreement

Local politics disregard the kunuku landscape

A final element that reoccurred in many interviews was the understanding that local politics neglect the kunuku landscape. Because of an economic reorientation in the past, most political attention seems to rest on the tourism sector. Interviewee 12: *The kunuku is not a priority. You see: in every meeting […] what you see is only talking about tourism, tourism, tourism, tourism, and never talking about fishing, for example, not talking about agriculture.* Resulting from a lack of political attention, public infrastructure is deteriorating and law enforcement is lagging. Interviewee 1: *In the last 30 years, government has not shown any attention for that area, as a consequence, the roads are bad, there are no facilities, there's no electricity, there are no schools nearby…* . Interviewee 4: *Yes, they sell in the soil instead of planting it, and the government doesn't control it.* Interviewee 13: *When you have video and footages, you go to the police with it and nothing will happen.* As a result, stakeholders operating in the kunuku landscape share the common frame that local politics have no interest in the kunuku landscape. Interviewee 9: *In the end, there is no real interest of the government to do it. I think so. I think so.*

This does not mean, however, that stakeholders turn their back on the local government. Results of this research show that the local government is understood as a very powerful actor (see section RQ. 2.1 – Important stakeholders) who can crucially contribute to achieving the 2050 vision of a sustainable kunuku landscape (see section Responsible actors).

Next to converging frames, this research identified six issues on which stakeholders do not share a common understanding.

Substantive ambiguity

What is a kunuku?

There is common agreement that in the past, kunukus were the major sites of local life as well as food production. However, opinions differ of what constitutes a kunuku in the present. Firstly, kunukus are described as the centres of cultural heritage. Interviewee 2: *It's very culturally and historically, the way Bonaire was.* In this sense, a kunuku is an iconic place in which grandparents followed the traditional cultural lifestyle characterised by a general sense of calmness and closeness to nature. Interviewee 4: *The kunuku area is an area; for example, my grandmother used to live in the kunuku.* Interviewee 13: *It was a relaxed way of life, you were at peace with yourself and more connected to nature.*

Secondly, kunukus are understood as businesses that involve agricultural production, either in form of crop harvesting of livestock farming. Interviewee 11: *So for me, you need kunuku as an area that needs to have some kind of production and you need to produce food. Not only for yourself, but for the surrounding area. And that's basically what kunuku is for me.*

In short, despite its centrality in Bonairean history and culture, the definition of "kunuku" is unclear. Is it enough for a house to be placed in the kunuku landscape to be a kunuku? Or is a kunuku a location of ongoing agricultural activity, or at least site of a certain value creation? To design and implement kunuku-related policies, it seems vital to consider differences in understanding of what constitutes a kunuku.

Why pursuing agriculture on Bonaire?

Interviewees have fundamentally different understandings of why agriculture should be pursued on Bonaire. On the one hand, stakeholders envision large-scale agriculture with the purpose of ensuring island-wide self-sufficiency. The objective is to acquire the ability to independently feed the local population, thereby gaining independence from expensive food and feed imports. Interviewee 6: *And we are an island. So everything has to be imported. See in Europe, you can go by truck, you can deliver. But with boats, it's very expensive right now. So I think those are the things that are in the way of getting people again on the kunuku*.
On the other hand, stakeholders talk about small-scale agriculture which is closely linked to maintaining the cultural heritage. In this perspective, positive contributions of local agriculture to food security on the island are understood as an important co-benefit, but self-sufficiency is not the major objective. Interviewee 4: *We lived in the house, and we go to the kunuku a couple of days, or only in the weekends. That's what it became now. So particular things are we plant mostly for ourselves. But there is no - what do you call it - commercial selling.*

Diverging frames about the purpose of agricultural activities on Bonaire also causes different expectations regarding agricultural products. Individual expectations range from generating feed for local livestock to supplying vegetables and fruits to supermarkets and producing specialised agricultural products that have a high touristic potential (e.g. agave for tequila production). Interviewee 9: *And, you should be able to plant grass. [...]Then we don't need to buy the hay or even the kunukero doesn't need to buy hay*. Interviewee 12: *But nowadays a lot of Dutch people are coming to the island, and they also are looking for more specific products of the island. This means, if we use our soil to produce a lot of things, then we can sell them also to our tourists.*

To sum up, this research identified two different purposes for agriculture on Bonaire: ensuring (a certain degree of) self-sufficiency and maintaining cultural heritage and the iconic, cultural kunuku landscape. For policy-making, it seems important to realise the inherent trade-offs between these two approaches to agriculture.

What does urbanisation mean for the kunuku landscape?

Many stakeholders identify the development of the kunuku landscape for housing as an ongoing trend. Interviewee 2: *But at the moment, [Bonaire] is becoming less and less rural, actually, more and more urban, I'd say. There's slowly more and more houses crawling up the kunuku area […].* However, conflicting frames exist about whether or which aspect of this development is problematic.
On the one hand, urbanisation is understood as a problem in itself, endangering the traditional

kunuku landscape. Interviewee 8: *The latest trend is that people start building houses, at places where they there never used to be house, and they kind of occupy kunuku terrains that used to be kunuku, and now there are, you know, regular houses. That's my main worry.* As a consequence of people moving into the kunuku landscapes, life gets harder for kunukeros. Neighbouring dogs cause significant damage to livestock and noisy farm activities may face legal complaints from bordering residents. Interviewee 14: *Especially in this era there are a lot of problems because the populations moving closer and closer. And those dogs that live close, they come in into the kunuku area.* Interviewee 11: *If they build too much around it, claims may start coming in. But it's a farm. I mean, goats and sheep, they're loud.*
On the other hand, allowing and supporting resettlement of the kunukus is understood as crucial to increase the political weight of the kunuku landscape, to insure the maintenance of infrastructure such as roads and water access and to reduce thefts. Interviewee 11: *Let me build a decent house so I can be there. If I'm there on the farm every day all the time. If I'm not there, my wife is there. My kids are there. My dogs are there. It's protected from theft, because they know people are there*. Interviewee 13: *Yeah, all these problems together, they may have a louder voice if more people come and live in the kunuku areas, there will be more life in the area which might bring down the thefts.*

There is no common stance regarding housing in the kunuku landscape. Urbanisation is understood as a problem and a solution at the same time. Policies that address housing in the kunuku landscape may face fierce resistance if they ignore the different frames at play.

It is important to see the interlinkages between the three identified objects of substantive ambiguity. A certain definition of a kunuku entails a specific stance towards agriculture on Bonaire, further implying a particular perspective regarding housing in the kunuku landscape. Publicly recognising differences in understanding and fostering an open debate between stakeholders can be first steps to align diverging ways of understanding.

Strategic ambiguity

What is the role of the LVV?

Two mayor different frames exist about the actions of LVV (*landbouw-veeteelt-en-visserij*), the local department for agriculture, animal husbandry and fisheries on Bonaire.
The first framing is widely supportive of LVV's current approach that is understood to centre around the demonstration of best practises and supporting locals in their first steps in agriculture. Both are understood as essential for the development of an agricultural sector on Bonaire. Interviewee 6: *I think that LVV is going doing a good example. And they are there. […] So I think we have to do the good practice. Show them again, what it is and what it was, and then very slowly introduce that to the population*.
The second framing, however, shows little understanding for the current actions taken by the LVV. The LVV reduced its support for active kunukeros. Even worse, the department is not only disregarding locals that already pursue agricultural activities in the kunukus, but it also directly competes against them: the not-for-profit production of vegetables, fruits and livestock of the LVV are met with incomprehension. Interviewee 14: *In the past, maybe back, LVV used to help you know. Cover like half the things for Kunuku. It could have helped. But now, they don't cover anything. There's zero help from LVV, let me put it that way.*
Interviewee 11: *And they should talk more to the kunukeros. I mean, seek and find real kunukeros. Because there are some out there. They are willing. They just need a little push. I push myself but some of them don't.*

To summarise, there are diverging interpretations about the actions of the LVV. Is it the mission of the LVV to support already existing farmers in the kunuku landscape or to develop an agricultural sector from scratch? The LVV is regarded a very influential and knowledgeable actor (see RQ. 2.1 – Important stakeholders). It therefore makes sense that its actions are watched closely. Finding itself at the centre of strategic ambiguity, the LVV might profit exceedingly from clear communication and active interaction with stakeholders.

Institutional ambiguity

Who owns the kunuku landscape?

During the course of the interviews, a general confusion about the ownership structure of properties in the kunuku landscape became apparent. Some describe kunukus as traditionally privately-owned properties, that are passed on over generations. Interviewee 5: *From what I know about this area, it consists of different kunukus owned by different families. Most of them are part of a heritage. So families that pass the land to their children and so on.*
Interviewee 8: *So a lot of kunukus are owned by families […].*
Others claim that the kunuku landscape is historically owned by the local government.
Interviewee 3: *And what defines also the Kunuku area is that it is government's terrain.*
Interviewee 9: *In Bonaire we have a lot of land. What you need is a good Kunuku from the government. They are very good and very cheap because this land is rented. We rent this, it's not ours.*

This finding does not suggest that property ownership in the kunuku landscape is legally undefined. It rather shows that the ownership structure is complex and allows multiple interpretations, which can result in a lacking sense of responsibility for the kunuku landscape.

What is Bonaire's goat farming tradition?

There are diverging understandings of Bonaire's tradition in goat keeping, which leads to different frames regarding current policy efforts to put a halt on free roaming goats on the island.
On the one hand, stakeholders argue that free roaming animals are a fundamental characteristic of Bonaire's tradition in goat farming. Goats are creative and hardy enough to find their own food when roaming through the kunuku landscape. It is understood as a pleasant feature of the landscape that goats nightly return to their kunukus, where the kunukeros main task is to provide them with additional feed and water. Forcing kunukeros to keep their goats inside would put a drastic halt to this tradition. High prices for feed would make small-scale livestock farming economically infeasible. Interviewee 7: R*ight now, the way you do it if you have a kunuku: let's say you go in the morning, you open up the gates and the goats they just go out and walk around. And the end of the day, they will come back to their own kunuku. And you know, by then they were feeding around and actually the only thing you have to supply is the water.* Interviewee 9: *Then we have some people with goats production and with cattle, especially goats. With the goats, they have a system of keeping them in the kunuku and then every day they open up the gate and let them go out. And at night time they come back by themselves and they get a little bit of extra food. But the goats have to go outside and try to find something to eat. And it's very nice with those goats that they have a route they go every day, and you know, then they come back.* […] *the goats are not allowed to go out because they are afraid.[…] they say that the goats are eating the landscape, that they eat everything and that that's the reason why Bonaire is getting drier and drier. I myself I do not believe in that story.*

On the other hand, stakeholders insist that the initial tradition of goat farming was not based on free roaming animals. In order to be a responsible livestock owner, people in the past controlled and monitored their herd and safeguarded it against theft. This is incompatible with the current approach of letting goats roam in an uncontrolled manner to realise opportunistic profits. Furthermore, it's emphasised that free roaming goats cause significant damage to the natural vegetation on the island. Interviewee 12: *Okay, you have to organize. If you want to have a lot of goats for meat or for milk, you have to organize them. They can't walk everywhere on the island that's not the way to do good business. If I want to steal a goat, I can do it very easily now. […] you have to control everything. If you don't see them, you are not in control.* Interviewee 11: *A lot of people on Bonaire still have goats and sheep which they let run freely to get their food. So that's also a big problem on Bonaire.*

Goat keeping is a tradition on Bonaire. However, it is unclear under which circumstances and rules goat keeping took place in the past. Diverging understandings of the traditional approach to goat keeping results in conflicting frames about the current way of goat farming. Shedding light on traditional goat farming practises may support a less entangled and more constructive discussion about appropriate forms of goat keeping in the present.

In brief, confusion exists about legal ownership and institutionalised farming practises. Such institutional ambiguity could be mitigated through court decisions and their subsequent legal enforcement or inclusive and open negotiations.
Answering RQ 1.1, this research has identified six objects of ambiguity related to the kunuku landscape. To create a broad momentum for positive change, it is important to openly discuss those different ways of understanding. Furthermore, policies that take advantage of unifying frames can support social cohesion and motivate action. Figure 5 provides an overview of the results presented in this chapter.

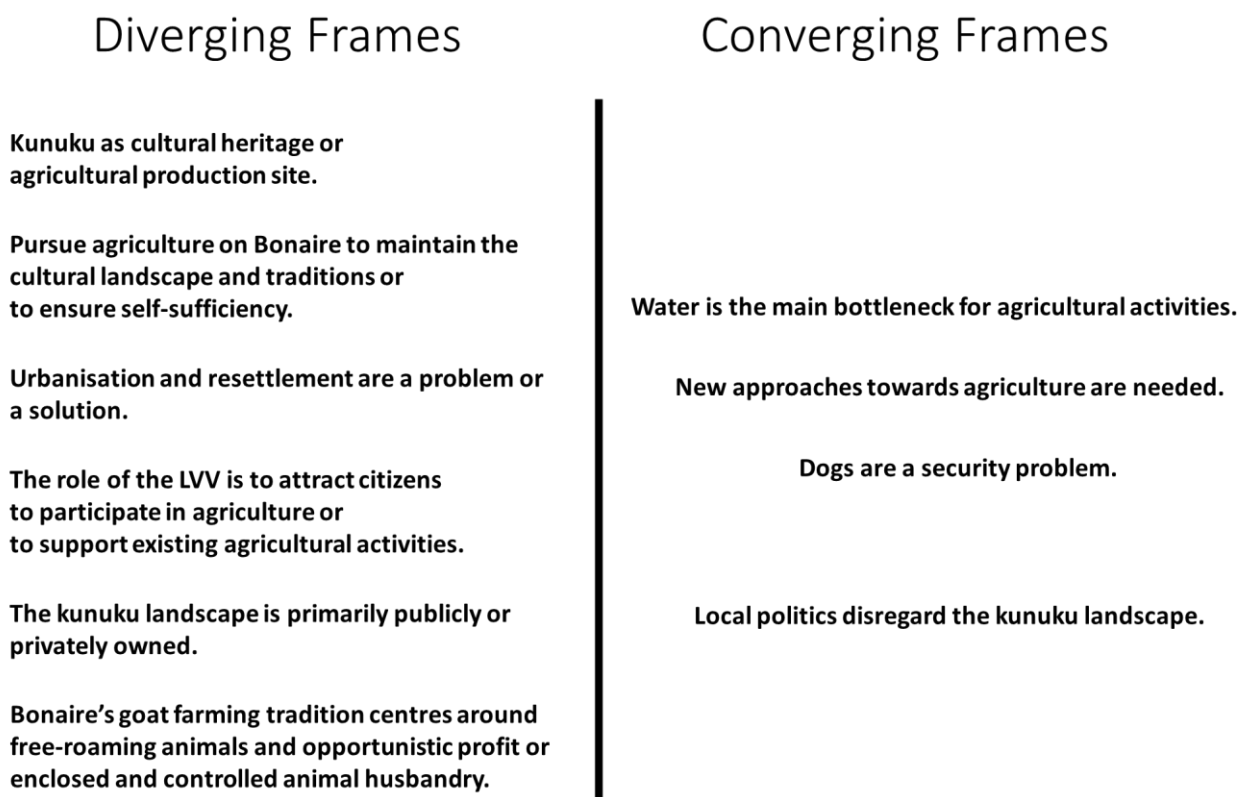

Figure 5: Diverging and converging stakeholder frames related to the kunuku landscape on Bonaire.

RQ 1.2 – Analysis of visioning process

RQ 1.2: What constitutes the kunuku visioning process?

What were the ultimate aims?

According to the interviewee, and in line with an acknowledgement in the report, the research project under which this visioning process was conducted is part of a broader research program of the Wageningen Research institute called 'Biodiversity in a Nature Inclusive Society'. Consequently, the considered visioning was part of a greater set of activities to examine how stakeholders can participate in transitions towards nature-inclusive societies. Following the interviewee, the research project aimed at finding new approaches to include the concept of nature-inclusiveness in spatial planning to supplement traditional conservation activities.

Why was this foresight process undertaken?

As described in the report, the central element of this visioning process was a stakeholder workshop. The interviewee stated that the aspired output of this workshop was a set of locations at which local stakeholders would like to implement certain nature inclusive measures. At the same time, the workshop had the purpose to test ideas about improving biodiversity and to raise awareness about Bonaire's environmental problems. The interviewee clarified that the workshop was not intended to create future visions, but to define suitable locations for measures to improve biodiversity.

Who was funding and participating?

As disclosed in the report, the research program, 'Biodiversity in a Nature Inclusive Society', and therefore also this foresight process, were funded by the Dutch Ministry of Agriculture, Nature and Food Quality (*Ministerie van Landbouw, Natuur en Voedselkwaliteit;* LNV). The interviewee explained that the research project itself was initiated by a team of researchers from Wageningen Research.

According to the interviewee, two stakeholders from the sectors agriculture and fisheries, tourism and nature conservation as well as two employees of the governmental spatial planning division and one person from the funding LNV were initially invited to participate in the respective workshop. The interviewee explained that the actual attendance, however, was skewed towards participants from the field of nature conservation because invited parties brought along further stakeholders. Following statements of the interviewee, multiple additional stakeholders offered their perspective to the research team after the workshop. All offers were accepted and all stakeholders were disclosed in the report. Based on the report, Figure 6 shows the participants of the entire visioning process.

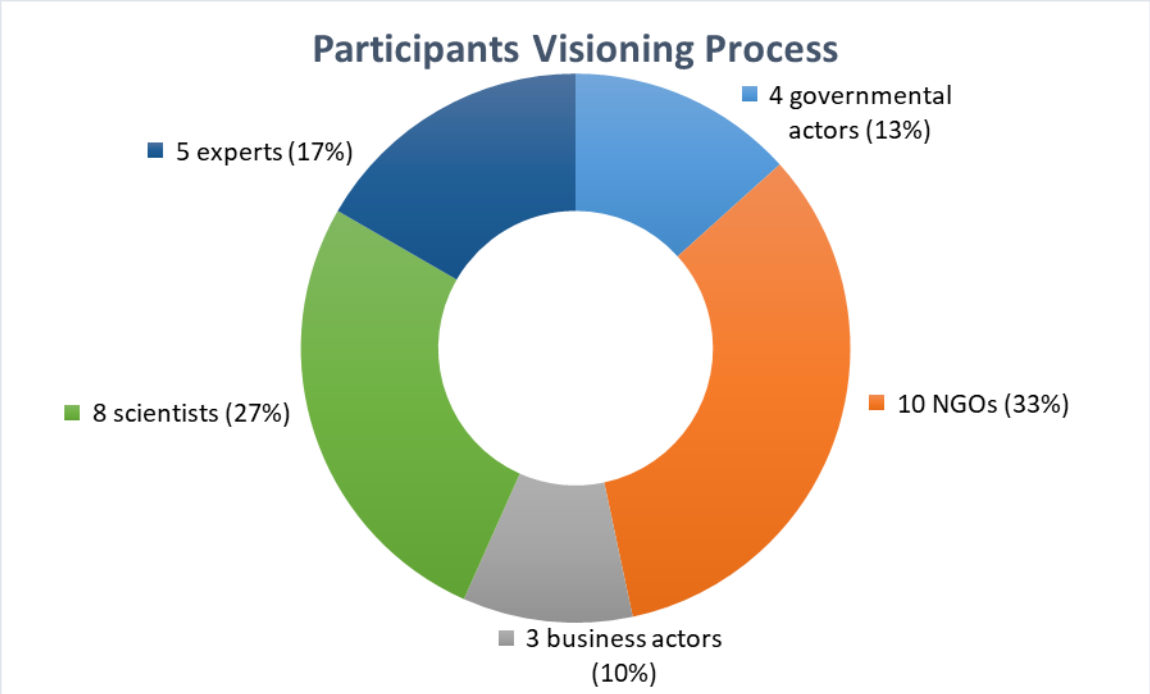

Figure 6: Participants of the visioning process by Verweij et al. (2020).

Overall, 30 people participated in the visioning process. Constituting 33% of all participants, (environmental) NGOs were most strongly represented. Further notable is the strong presence of scientific and expert knowledge. Knowledge and perspective of lay people and the wider public was not represented.

What methods, tools and processes were used?

The major method applied consisted of a five hour long workshop that was described as follows by the interviewee. The workshop started with a presentation of scientific data by the research team. The presentation was focused on the quantification of trends in Bonaire. For example, data on groundwater salination or forecasted sea level rise and climate change was displayed. Afterwards, participants located nature inclusive measures in the form of cards on a map. A set of nature inclusive measures was predefined by the researchers. However, participants had the possibility of writing their own nature inclusive measures on blank cards. Following the interviewee, the second method were interviews, through which additional perspectives were incorporated after the workshop session.

The interviewee described that identified nature inclusive measures were found to be distributed in a pattern across Bonaire. Therefore, those consistent sets of nature inclusive measures were used to delineate different Bonairean landscapes. The interviewee further explained that, during a validation of those landscapes, the research team found a strong overlap with other ecological and geological maps of Bonaire. Eventually, the visions for Bonaire 2050 were created. Those visions display landscape futures in which all aspired nature inclusive measures are implemented.

How was future conceptualised?

The interviewee, himself an organiser of the workshop, stated that the conceptualisation of the future did not receive special attention during the whole process. This was justified by stating that conducting a foresight was not the initial intent of the research project.

To what extent did the process tackle ambiguities?

Informational role

With the presentation of scientific data at the beginning of the workshop, this foresight process provided workshop participants with new insights and knowledge, thereby fulfilling its informational role.

Argumentative role

In contrast to the appended interviews, the workshop also took on the argumentative role of collective deliberation. Following the interviewee, workshop participants had the chance and time to interact and exchange perspectives. Due to unbalanced representation, the discourse might have been dominated by environmental NGOs, thereby putting a strong focus on environmental aspects. However, the interviewee reported of passionate debates regarding spatial zoning of the coastlines as well as the merits of coral restoration. This indicates that controversies were able to surface. The separated interviews did not contribute to the argumentative role of this foresight.

Reflective role

The act of selecting suitable nature inclusive measures and locating them of a map describes a kind of reflective process. However, the interviewee stated that some pre-defined measures are inherently tied to certain landscapes. For example, roof-top water harvesting is logically linked to housing areas.

Social role

By provoking the interaction between stakeholders from different sectors, the workshop ensured that the visioning process was also taking on a social role. However, the division of workshop participants and interviewees remains unclear from the stakeholder list in the report.

What are the policy implications for the present?

The intimidating trends presented at the beginning of this foresight indicated that action is necessary to safeguard the natural environment. According to the report, the output of the described process were visions for Bonairean landscapes in 2050, in which nature inclusive measures counter those trends and support biodiversity as well as people on the island. In this sense, this environmentally-oriented and expert-driven foresight calls to action and provides an overview over a set of actions that could be taken to avoid an unappealing business as usual.

RQ. 1.3 – Analysis of backcasting process

RQ 1.3: What constitutes the kunuku backcasting process?

What were the ultimate aims?

As stated in the process agenda, the aspired overall outcome of the workshop in which the backcasting took place was to broaden the horizon of participants by connecting them with stakeholders from other sectors.

Why was this foresight process undertaken?

Following the process agenda, the pursued output of the backcasting process was a list of specific actions to achieve the 2050 kunuku vision.

Who was funding and participating?

Figure 7 displays the participants of the backcasting foresight according to the participation records.

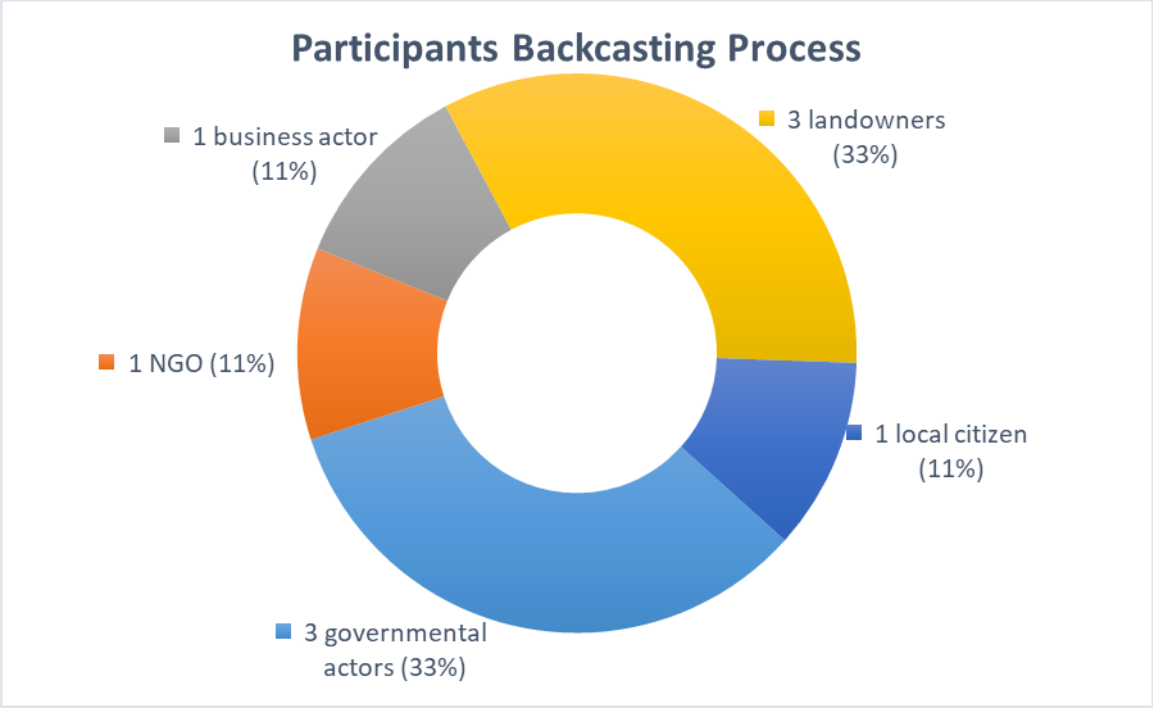

Figure 7: Participants of the backcasting process conducted in this research.

Nine stakeholders attended the workshop. In contrast to the visioning process, scientific knowledge was not represented in the backcasting process. A further difference is that only one (environmental) NGO participated in the backcast. Land owners and governmental actors were strongly represented, with one third of the participants belonging to each of those categories. Table 1 shows the participation guidelines for the backcasting workshop resulting from the Prospex-CQI method. All but one criteria were fulfilled. The fact that only one woman participated leads to a significant gender imbalance in this backcasting process.
No external funds were accessed for this backcast.

Table 1: Prospex-CQI method, aspired and final participation quotas.

Category	Aspired Quota	Final Quota
Gender		
Female	40%	11%
Male	40%	89%
Age Group		
below 40 years old	20%	33%
40-65 years old	40%	56%
65 years and above	10%	11%
Stakeholder category		
Governmental actors	10%	33%
NGOs	10%	11%
Business actors	10%	11%
Land-owners	10%	33%
Local citizens	10%	11%
Affecting and Affected		
Most affecting	20%	67%
Most affected	20%	44%

What methods, tools and processes were used?

This workshop centred on a single method: participatory backcasting. This method was chosen because it offers a scientific approach to support participants in designing activities to reach a certain vision. As captured in the process agenda, the workshop took four hours and included three guided brainstorming sessions (milestones, obstacles and opportunities, actions). For more information see RQ 2.2 – Backcasting Workshop.

How was future conceptualised?

Because a backcast is a normative scenario building tool, the future was portrayed as undetermined: if the future would be certain, why bothering with a normative future starting point? By focusing on an aspired future and "walking backwards" to the present, backcasting allows a performative conceptualisation of the future. The method sheds a light on the consequences for the presence in case a certain future is meant to be achieved.
In the participant survey, one participant described the relationship between future and presented in the workshop as: "*If you strongly visualise the future you want, you can increase your chances of realising it.*", indicating a performative conceptualisation of the future. Because of the fundamental claim that every future is imaginable and that actions can be taken to steer the future, a backcast describes the future as unknowable and influenceable. This resonates well with findings from the participant survey. Five out of nine participants indicate that the future was understood a uncertain. Moreover, six out of nine stated that the future was observed as manageable, with only one participant mentioning that the future is "uncontrollable".

To what extent did the process tackle ambiguities?

Informational role

Besides a presentation of the major aspects of the 2050 kunuku vision, which were already known to some participants, the process agenda indicates that no new information was provided to the participants. This is one of the weak points of this backcasting process.

Argumentative role

Third-person workshop observation notes show that especially the identification of obstacles and opportunities led to intense and sometimes heated debates among participants. This indicates that controversies were discussed openly. Observation notes further report that participants accepted diverging perspectives and used the workshop as an opportunity to explore differences in opinion. However, discussions only took place within working groups. Interactions between groups was very limited.

Reflective role

Observation notes show that specific actions were actively discussed and negotiated. Assessing and bargaining future actions requires participants to reflect on their own preferences and assumptions. Nonetheless, group consensus on actions was not required.

Social role

Observation notes describe the atmosphere during the workshop as bright and enthusiastic. Even during the breaks, stakeholders were observed to be actively engaged with each other on a diverse range of topics. Eight out of nine participants state that the variety of participants at the workshop was an aspect they especially appreciated. Within the working groups, different levels of social cohesion were noted in the observation notes. While one group collaboratively marked sticky-notes, participants in the second group worked rather individually.

What are the policy implications for the present?

As described in greater detail in the section 'RQ. 2.2 – Pathways of action', results of this backcasting process show that a wide range of actions need to be taken in order to achieve the aspired 2050 kunuku vision. Actors responsible for implementation were specified within the process.

RQ. 2.1 – Important stakeholders

RQ 2.1: Who are important stakeholders regarding the kunuku landscape?

Mapping stakeholders

Interviewees named a total of 66 stakeholders. This number includes duplicates. Grouping stakeholders and taking those duplicates into account resulted in a smaller number of 27 stakeholders. The stakeholders most often named are the local government (count of 9), the LVV (local department for agriculture, animal husbandry and fisheries; *landbouw-veeteelt-en*-visserij, 7) and the local farmer association Kriabon (6),

Figure 8 displays the influence-dependency matrix related to the kunuku landscape that resulted from the stakeholder-driven stakeholder categorisation. "Influence" describes the power of actors to bring about change. "Dependency" describes the intensity with which the

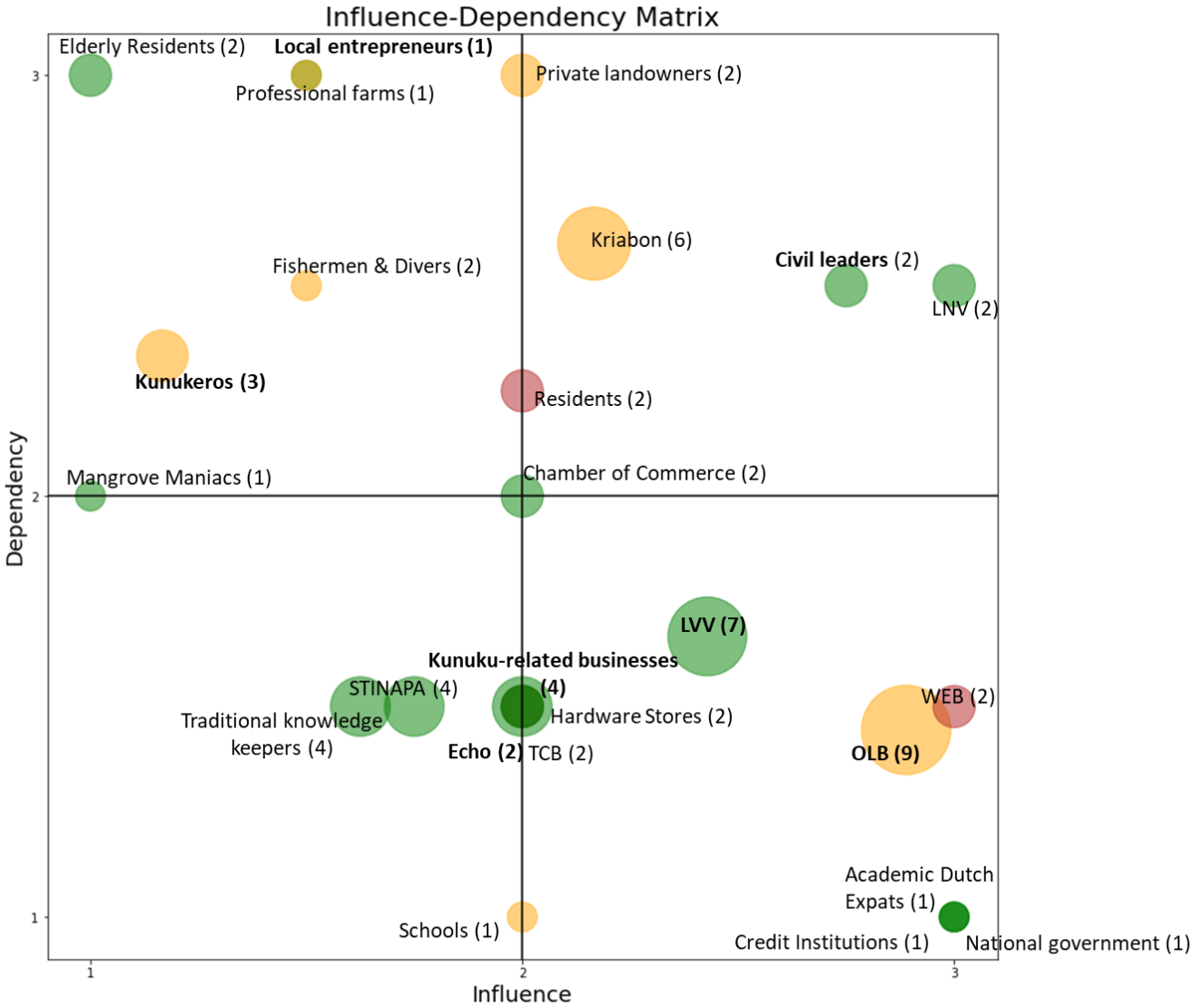

Figure 8: Influence-Dependency Matrix. The circle size displays how often a stakeholder was mentioned. The count is indicated in brackets. The circle colour indicates the level of expertise regarding the kunuku landscape that was assigned to a stakeholder. Red indicates a low, yellow a medium and green a high level of expertise. Bold font indicates that the stakeholder participated in the backcasting workshop.

*Abbreviations: LNV = The Dutch Ministry of Agriculture, Nature and Food Quality (*Ministerie van Landbouw, Natuur en Voedselkwaliteit*), STINAPA = environmental NGO (*Stichting Nationale Parken Bonaire), LVV = local department for agriculture, animal husbandry and fisheries (landbouw-veeteelt-en-visserij), TCB = Tourism Corporation Bonaire, WEB = local water and energy provider (Water- en Energiebdrijf Bonaire), OLB = local government (Openbaar Lichaam Bonaire).

livelihood or interests of stakeholders are affected by changes in the kunuku landscape. A tabular representation of the matrix can be found in the appendix (see Table 5). This section gives special attention to stakeholders mentioned more than once.

The Dutch Ministry of Agriculture, Nature and Food Quality (*Ministerie van Landbouw, Natuur en Voedselkwaliteit;* LNV) civil leaders as well as Kriabon are identified as key players in the kunuku landscape with the first two featuring high levels of expertise. The local government in general and more specifically the LVV are identified as major "Context setters", with the LVV enjoying the reputation of a knowledgeable institutions. Furthermore, the WEB (*Water- en Energiebdrijf Bonaire*), the leading local water and energy provider, is categorised as a powerful actor that is lacking expertise. Elderly residents living in the kunuku landscape as well as kunukeros emerge as major "Subjects", being very dependent on the kunuku landscape for their wellbeing but possessing only limited power to bring about change. The "Crowd" consist mainly of traditional knowledge keepers (i.e. local historians) and STINAPA Bonaire (*Stichting Nationale Parken Bonaire*), the NGO that manages the nature protected areas of Bonaire. Both are seen as knowledgeable but rather disinterested and powerless regarding the kunuku landscape. Overall, interviewees issued rather high levels of expertise to other stakeholders, with only two actors being identified as featuring low levels of expertise.

Exploring the matrix

The matrix shown in Figure 8 indicates that governmental stakeholders, either belonging to the local or the national government, are very powerful actors. To achieve changes in the kunuku landscape, highly dependent stakeholders may want to actively pursue cooperation with the LNV and think about ways to raise the stakes for the local government. A significant part of stakeholders is neither strongly affected by nor affecting the kunuku landscape. This correlates with the widespread understanding of stakeholders that, at the moment, the kunuku landscape is largely abandoned, with little economic activity taking place. This may imply that not many stakeholders have an agenda on the kunuku landscape. A small number of important stakeholders may ease tackling the prevailing ambiguities identified above (see RQ 1.1 – Converging and diverging frames) and facilitate the collaborative creation of policies regarding the kunuku landscape.

RQ. 2.2 – Pathways of action

RQ 2.2: What are co-created pathways to achieve the 2050 kunuku vision?

Generated items

In total, 188 items in the form of actions, milestones, obstacles and opportunities were created during the backcasting workshop. As shown in Table 2, almost half of the designed items were actions, of which 64% were identified as specific actions. This means they were related to other items and included a specification of responsible actors for their implementation. Stakeholders struggled with identifying opportunities, which only count for 6% of all items.

Table 2: Backcasting items.

Pathways	Actions	Milestones	Obstacles	Opportunities	Total
Agricultural activities for self-sufficient Bonaire	38	16	11	3	68
Creation of touristic & cultural value	35	12	18	3	68
Water harvesting & energy production	18	13	16	5	52
Total	91	41	45	11	188

The distribution of items across the three vision aspects is balanced, with each vision aspect accounting for approximately one third of the items. Because the research question focuses on the creation of pathways, presented results focus on milestones and (specific) actions.

Pathways, strategies and specific actions

After the workshop, the 41 milestones were aggregated into 11 overarching strategic objectives. By subsequently relating actions to those objectives, 11 strategies were created. In a last step, non-specific actions were filtered out. Table 3 provides an overview of the 11 strategies related to the three pathways towards the 2050 kunuku vision. The pathway focused on agricultural activities is the most elaborate, consisting of six strategies and 27 specific actions in total. This is not surprising, because most participants came from the agricultural realm. The specification of actions targeting local energy production and water harvesting was most difficult for stakeholders. This is because stakeholder felt like they lack the technical knowledge to address these issues in greater detail.

Table 3: Overview of generated pathways and strategies.

Pathways and Strategies	Specific actions
Local energy production and water harvesting	**11**
Zero import of fossil fuels	5
Increased water availability	6
Creation of touristic and cultural value	**20**
Marketing of Bonairean culture	10
Public awareness about Bonaire's history and cultural heritage	9
Promotion of Bonairean values and norms	1
Agricultural activities for a self-sufficient Bonaire	**27**
Accessible agricultural education	5
Enhanced cooperation	3
Innovative agricultural systems	5
Dense vegetation cover	8
Integration of neighbourhoods into agricultural activities	5
Local food production	1
Total	**58**

Table 4 briefly describes the pathways and their respective strategies. Additionally, key actors within each pathway are indicated and exemplary actions are shown.

Table 4: Description of pathways and strategies.

Pathway	Content	Key actors
Local energy production and water harvesting	Local, decentralised energy production supports economic activities in the kunuku landscape and improved water management leads to a higher water quantity in the area.	OLB (*Openbaar Lichaam Bonaire*; the local government), the Dutch government and WEB (*Water- en Energiebdrijf Bonaire*; local water and energy provider)
Strategy Increased water availability	*Content* In cooperation between private and public actors, infrastructure to harvest and store water is either built, improved or replaced by innovative alternatives. A new department centralises water management.	*Examples* o OLB and the Dutch government create an official department that is commissioned to govern the whole water cycle (incl. water harvesting & distribution). o WEB, OLB and the Dutch government collaborate to improve current and build better water dams.

Zero import of fossil fuels	Together with the rest of Bonaire, the kunuku landscape becomes completely independent from fuel imports.	o WEB creates technical and regulatory environment that allows individuals to supply current to public energy network. o WEB, OLB and the Dutch government join forces in installing solar panels.

Pathway	Content	Key actors
Creation of touristic and cultural value	Bonairean culture is popularised within locals and tourists. Actively promoting Bonairean culture to incoming tourists expands the tourism industry and opens up new working possibilities for locals. Simultaneously, increasing public awareness about Bonairean history allows Bonaireans to rediscover and appreciate their cultural heritage.	TCB (*Tourism Corporation Bonaire*), property owners
Strategy	*Content*	*Examples*
Marketing of Bonairean culture	Bonairean culture is made easily accessible to tourists. Interactions between locals and tourists are encouraged and facilitated.	o TCB organises cultural workshops for tourists. o OLB allows bed & breakfast services of local families. o TCB, in collaboration with SGB (*Scholengemeenschap Bonaire*; secondary school) and art groups, promotes a 'Made in Bonaire' label for Bonairean art and handcrafts. o Property owners open their mansions for tourists.
Public awareness about Bonaire's history and cultural heritage	Educational campaigns aim at compiling and communicating local history. Historic sites and buildings are maintained and represent local pride about cultural heritage.	o OLB and the Dutch government invest in authoring books about local history. o Property owners restore old, traditional buildings. o Cultural groups and the Young Bonaire Foundation for Youth Work organise classes in sewing, drawing and folklore.

Pathway	Content	Key actors
Agricultural activities for a self-sufficient Bonaire	Agriculture is stimulated by disseminating agricultural knowledge into neighbourhood-communities and by experimenting	LVV (*landbouw-veeteelt-en-visserij*; local department for agriculture, animal husbandry and fisheries), OLB

	with novel approaches to food production. At the same time, nature restoration creates a favourable environment for agricultural activities.	
Strategy	*Content*	*Examples*
Accessible agricultural education	Knowledge related to agriculture and nutrition is made accessible to a wider audience.	o LVV transforms part of its department into an educational centre. o Local chefs collectively create a website that presents traditional and innovative recipes.
Enhanced cooperation	The coordination of stakeholder activities is facilitated and improved.	o LVV and Kriabon carry out pooled bulk imports of materials and equipment. o The Chamber of Commerce supports the conclusion of contracts between kunukeros and supermarkets.
Innovative agricultural systems	New approaches to agriculture are researched and tested.	o LVV tests and supports establishment of new farming methods such as hydro-and aquaponics and syntropic farming. o OLB recruits advisors specialised in regenerative agriculture.
Dense vegetation cover	Environmental assets are recorded, maintained and enhanced.	o OLB and STINAPA record, map and improve ecosystem services on the island. o OLB starts reforestation programmes for the youth. o STINAPA and LVV initiate and lead long-term reforestation projects.
Integration of neighbourhoods into agricultural activities	Neighbourhoods are vitalised by creating sites of food production and trade.	o LVV and LNV collaborate with a group of interested citizens to start constructing sustainable houses and gardens. o Echo cooperates with locals to construct private greenhouses.

A list of all specific actions can be found in the appendix (see p. 56).

Responsible actors

Participants identified 34 different actors that are seen as responsible for implementing actions. In line with results of RQ 2.1., the most often named actor was the local government of Bonaire (OLB), being identified as (partly) responsible for 23 actions. Other actors with high count are the LVV (13), the tourism corporation Bonaire (TCB, 8) and the Dutch government (6). This result indicates, that stakeholders see it mainly as the responsibility of well-established institutions to implement the suggested actions. The high number of actions suggested to the TCB, responsible for most of the actions in the strategy *Marketing of Bonairean culture* does not concur well with the rather low dependency of the TCB on the kunuku landscape, as indicated in the stakeholder matrix. The Dutch government and WEB (*Water- en Energiebdrijf Bonaire*) are especially present in the pathway *Local energy production and water harvesting*. The LVV is responsible for a significant number of actions in the pathway *Agricultural activities for a self-sufficient Bonaire*.

Participant evaluation

Participants expressed their satisfaction with the workshop in the participants survey. As Figure 9 shows, all stakeholders were either satisfied or very satisfied with the workshop and eight out of nine participants were (very) satisfied with the provided instructions. Furthermore, most participants indicated satisfaction with the created output of the workshop. As mentioned above (see p.26), participants especially valued the diversity of participating stakeholders. Suggestions of improvement from the participants include shortening the time of the workshop as well as providing a walk-through example of a backcast at the beginning of the session.

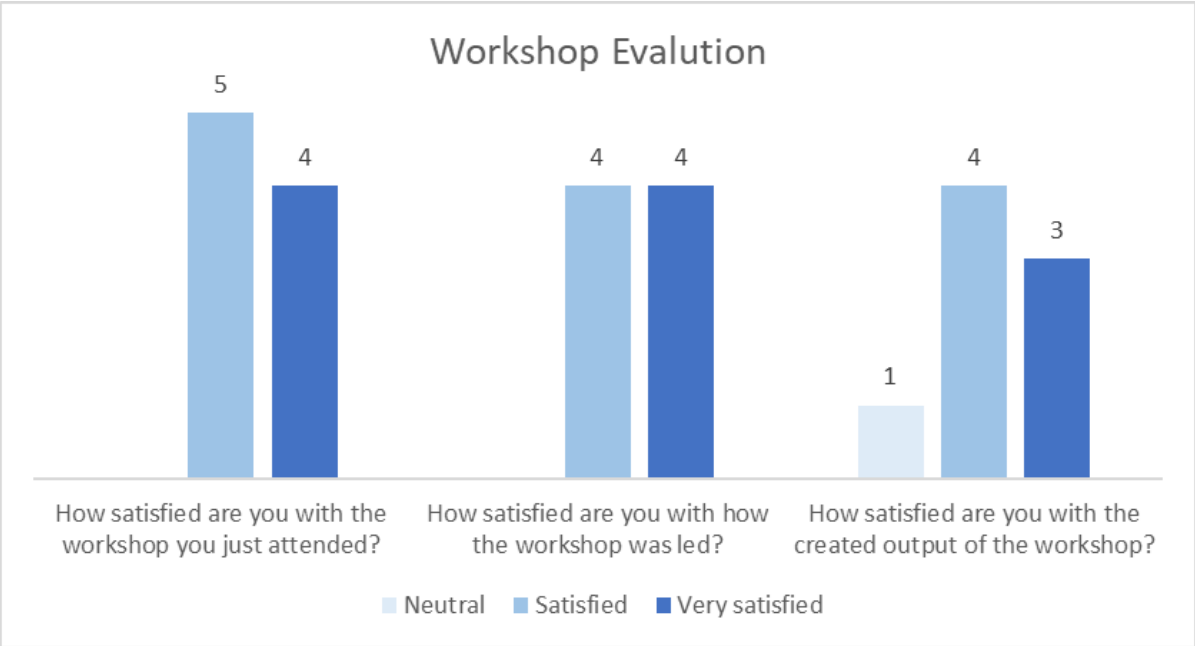

Figure 9: Workshop evaluation, based on pre-workshop survey. Questions regarding workshop lead and output were only filled out by 8 participants.

Discussion

This chapter is structured into two parts. The first part is a discussion of the methodology applied in this research and its pitfalls. The second part reflects on the assessed foresight processes and discusses the implications of findings for anticipatory governance. Cinquains are used to facilitate the communication of central messages.

Methods and caveats

If
imagination is
all that it
takes, what is the
problem?

TA & Ambiguity

This research applied a thematic analysis (TA) to identify ambiguities related to the kunuku landscape on Bonaire. Other recent approaches to make ambiguity legible come from the realm of modelling. Thereby, ambiguity is formalised by mapping stakeholder`s system understanding with the help of boxes and arrows. de Jong & Kok (2021) applied Fuzzy Cognitive Maps (FCM) to examine ambiguity in social ecological systems in Kenya. Pluchinotta et al. (2022) use causal loop diagrams (CLD) to formalise different frames regarding the Thamesmead area in the UK. Within such modelling exercises, ambiguity is formalised within different system models. Specifically, different frames surface in the form of differences in concepts (boxes) used, potency of drivers and relationships (arrows) between those (de Jong & Kok, 2021).

In contrast to modelling approaches, a TA sets almost no barriers to participation. Participating stakeholders are not required to master 'system thinking' and portray their perspectives in the form of boxes and arrows. A TA based on semi-structured interviews allows for a wide range of participants regardless their educational background and capabilities of systematic thinking, provided that the underlying interview questions are formulated in a comprehensive manner. Moreover, it can be seen as a strongpoint of a TA that its output is a story. Even without a lot of background information on the method, stories allow a clear and tangible communication of different frames. It is important to note that differences in understanding are in reality not always as clear-cut as presented in this research. The sharpened line of argumentation in the results chapter must not give the impression that diverging frames are fundamentally incompatible. In some cases, stakeholders were even found to refer to multiple, contradicting frames within the same interview.

Without compromising the benefits of a TA, modelling approaches also have advantages. Equipped with a toolkit that only includes boxes and arrows, the created graphical representations of mental models are clearly structured. Differences in frames are visible with the naked eye. Nevertheless, the more complex a system, the less intuitive the interpretation of model output becomes, lowering its advantages regarding structure and visualisation. Another aspect is that the procedures to create FCMs and CLDs are easier replicable than

those of a TA. The TA can have a higher bias towards the researcher, who plays a pivotal role in acting as 'storyteller'. This is especially the case in this research, since the coding was only conducted by one person. No inter-coder comparison was taking place. As a result, a TA of the same data set by a second researcher might have yielded very different results. However, that is not to say that modelling approaches are free from biases towards the researcher. As described by de Jong & Kok (2021), concepts used as building blocks for models are often general and can therefore be interpreted in multiple ways. Bias towards the researcher can be introduced by framing the definition of contested concepts. Overall, it is hard to judge whether a TA indeed introduces greater research biases or whether a TA is just easier to criticise in this regard because the bias is more evident.

Extended analytical framework for foresights

This study extended the analytical framework for foresights proposed by Muiderman et al. (2022) to incorporate an assessment of how a foresight process deals with present ambiguities. This was done by assessing the extent to which a process enabled collective deliberation, which, according to Allain & Salliou (2022), contributes to the creation of shared frames.

The questions suggested by Muiderman et al. (2022) were helpful to ex-post explore foresight processes. Process-related questions allowed to describe how underlying objectives, applied methods and patterns of inclusion shape foresight processes. Equally important, answers to context-related questions helped outlining political objectives and implications of foresights. Understandably, it is especially the ultimate aim of a foresight that was found determining the characteristics of a foresight process.

The insights generated through the extension of the framework, by an assessment of a foresight's contribution to collective deliberation, are mostly beneficial to practitioners. The extension opened up new possibilities for scrutinizing and critiquing a foresight process, offering new possibilities for improvement and especially learning. It also showed that foresights need to push participants out of their comfort zones to take on the different roles of collective deliberation. Thereby, the extension might also enhance the ex-ante planning of foresight processes by stimulating foresight organisers to more thoroughly plan stakeholder representation and interaction.

To shed a stronger light on the politics of foresights, further extensions to the analytical framework should target the context-related space. One option is to scrutinise the extent to which a foresight absorbs present political paradigms. The present situation always affects the imagined future (Vervoort et al., 2015). The crucial question here is, whether the imagined future is able to break free from long-established patterns of thinking that led to the unsatisfying presence or whether the imagined future is just a plain prolongment of current policies. Since current deeply entrenched assumptions are historically grown, identifying and understanding them requires paying stronger attention to the past. Additional questions such as "What political paradigms exist in the present?" and "To what extent do political paradigms reappear the imagined future?" can critically enhance the context-oriented part of the framework.

If used to analyse foresight processes from external parties, all parts of the framework highly depend on cooperation of the foresight organisers. Information needed to answer the questions posed can largely only be provided by those organisers. Additionally, the framework decreases in usefulness with increasing time between the foresight process taking

place and the analysis thereof. Organisers might find it increasingly difficult to provide the detailed information needed. This is even more the case for participants, whose interrogation is critical to triangulate the perspective of organisers. The fact that this research was unable to connect to participants of the visioning process is a major limitation of this study.

Backcasting

A general risk associated with backcasting is the potential emergence of an assumption drag, which causes future imaginations being based on present-day assumptions and knowledge, thereby falling short of envisioning truly transforming futures (Vergragt & Quist, 2011). Further disadvantages are that the measures designed within the backcast can turn out to be of rather unspecific and vague character (Kok et al., 2011) or that they might implicate exorbitant hight costs in the short term (Börjeson et al., 2006).

The actions created in the backcast show a high reliance on established institutions. This may be a sign of an assumption drag. 'New' actors, that are inexistent in the presence, were not envisioned as being responsible for future actions. Furthermore, participants did not picture actions that are challenging the current top-down policy approach on the island. This can either indicate a general preference for governmental action or show how difficult it is to imaging different ways of governing. Because of its focus on governmental measures, the design actions also lack actions that could be taken by individuals. While clearly showcasing the importance of collective action, the usefulness of the backcast results might therefore be limited for individual stakeholders.

Further, the low number of identified opportunities might indicate difficulties of stakeholders in engaging with the benefits radical different future. Only about 6% of all items of the backcast were opportunities, a small fraction compared to obstacles which account for more than 20% of all items. This resonates with research that shows that humans tend towards a pessimistic take of the future (Herwig et al., 2007). While obstacles proved to be helpful to identify future actions during the workshop, opportunities could shine a more positive light on the future, thereby encouraging the imagination of radical transformations.

Specificity is understood as central to ensure relevance of the backcasting results and to initiate follow-up actions after the workshop. Regarding the specificity of the designed measures, the workshop put a lot of emphasis on creating actions that are precise regarding their underlying logic and responsible actors. The part devoted to creating actions was the longest of the four brainstorming sessions of the backcasting workshop. The efforts were rewarded with 58 out of 83 total actions (64%) being specific. So even with the whole workshop centred around *specific* actions, almost 40% of actions turned out to be of very vague nature. The "specific" actions that result from this research are still relatively unspecified regarding time (starting point and end point of actions) and priority. In the face of finite resources, the results do not provide guidance about the relative importance of designed actions. This is crucial, since it is unrealistic that all actions can be implemented. Most importantly, lacking specification in time and priority hampers answering the most important question: How to start?

Moreover, many specific actions do not explicitly target the kunuku landscape as focal point. Installing solar panels and building greenhouses in neighbourhoods, for example, are measures that are not bound to the kunuku landscape. However, general applicability of actions does not implicate lower relevance for the kunuku landscape.

Whether the designed actions would lead to excessive short term costs cannot be said because

costs of measures were not assessed. It is not clear which actions should be taken in the short term.

What is more, is that semantics were found to play a big role in the backcast. This is important because it suggests a potential source of researcher bias in the method. When left unelaborated, a single statement can constitute a milestone (e.g. Improved agricultural education), an obstacle (Lack of agricultural education), an opportunity (Enhancing agricultural education) as well as an action (improve agricultural education). This issue was addressed in this research by requiring workshop participants to indicate on the sticky notes which type of item they want to capture. Un-marked items had to be interpreted by the researcher depending on the position of the sticky note on the poster.

Scenarios

Taking a broader perspective, imagining the future with the help of scenarios can be problematic. According to Pereira et al. (2019), scenarios can be based on biased assumptions, intensify power asymmetries and trivialise limited knowledge and uncertainties. Because the backcasting used the vision created by Verweij et al. (2020) as the aspired end point, this study may be biased towards the concept of nature-inclusiveness. This bias was addressed by merging the multiple elements of the vision into three general aspects. The actions resulting from the backcast don't show any sign of prioritising environmental issues over social and economic ones. Nevertheless, it was assumed that the created vision presents a normative goal that stakeholders truly want to achieve. Workshop participants did not oppose the three aspects of the vision when presented to them. This does, however, not mean that they personally would have named the same three aspects when asked for it. It might be that the generalness of the vision aspects allowed broad agreement. In this case, ambiguity may have supported group cohesion.

Principal uncertainties are essential to backcasting. It is the fundamental uncertainties in the first place that allow a limitless imagination of a desired future and to focus on a normative end point.

Limitations in knowledge were not trivialised but addressed by the stakeholders during the backcasting workshop. Some designed actions directly refer to closing knowledge gaps, for example research on tourism and assessing ecosystem services on the island. Other actions indirectly address the lack of knowledge by demanding, for example, innovative agricultural techniques, agricultural education and books portraying local history.

Because power asymmetries are discussed within stakeholder engagement in the next section as well, this issue is not addressed here.

Stakeholder engagement

Stakeholder engagement was a crucial element of this research. This transdisciplinary approach yielded pragmatic as well as normative benefits compared to a study not actively involving stakeholders.

From a pragmatic point of view, stakeholder engagement allowed to ensure that the produced knowledge is relevant for the wider public. The identification of ambiguities through semi-structured interviews produced an inexhaustible list of issues that can be addressed and clarified in future stakeholder and policy meetings. Furthermore, four uniting frames that can be exploited to motivate collective action were identified.

With pinpointing ambiguity indicating which subjects should be discussed, the stakeholder categorisation, based on the same interviews, suggests who should be involved in this

discussion. It does, however, not provide a yardstick that can justify exclusion of stakeholders. Further, it paints a coarse picture of stakeholders perception of the allocation of power, vulnerability and knowledge. The resulting matrix can be helpful for stakeholders by providing a general overview of stakeholders in the kunuku landscape and by indicating potential prospective partners. Stakeholder engagement also increased the legitimacy of the research output. While the stakeholder created actions are not checked for feasibility, effectiveness and efficiency for realising the 2050 kunuku vision, they still reflect the ideas and opinions of affecting and affected stakeholders, thereby having significantly more weight than similar actions designed without stakeholder participation. The same argument can be made regarding the stakeholder categorisation. As a last pragmatic benefit, stakeholder engagement significantly facilitates the distribution of the knowledge produced within this study. Workshop participants and interviewees are proud about their work and voluntarily contribute to a diffusion of the research results.
From a normative point of view, stakeholder engagement ensured a certain level of societal impact of this study. Irrespective of the results of the backcast, the conducted workshop was able to create a safe space for exchanging and discussing different perspectives and smoothed the way for future collaboration. Moreover, the backcast encouraged participants to appreciate their role in crafting the future of Bonaire.

However, the inclusion of stakeholder can also bear problems. Newig & Fritsch (2009) found that the individual environmental preferences of engaged stakeholders significantly determine the environmental outputs of decision making. Moreover, it is important to remember that enhanced engagement does not automatically lead to more environmental-friendly decisions (Bulkeley & Mol, 2003). Therefore, it is clear that engagement of private and societal actors in scientific research is not a silver bullet to tackle environmental problems. Stakeholder engagement can also absorb social power asymmetries and promote discrimination (Durham et al., 2014; Reed, 2008; Renn, 2006). Furthermore, perspectives of different stakeholders can be completely incompatible with each other (Habegger, 2010) and platforms for stakeholder engagement might be misused as 'talking shops' by being set up for the purpose of stalling change (Reed, 2008).

Based on the insights from Newig & Fritsch (2009), the low proportion of environmentally-focused stakeholders can be understood as a reason why environmental sustainability is not as present within the designed actions of the backcast as the social and economic pillars of sustainability. Only one strategy ("Dense vegetation cover") explicitly aims to improve the environmental quality on the island. However, multiple proposed actions, such as agricultural education and sustainable housing, could be assumed to indirectly improve the state of the natural environment. It makes sense to assume that higher participation of conservationist groups would have increased the number of actions targeted to safeguard and enhance nature quality.
Incompatible perspectives were not found to be a disturbing factor in this research. Within the workshop, observation notes indicate that participants interpreted different perspectives as an opportunity to learn. In general, the concept of ambiguity allowed to actively explore incompatibilities in understanding.

The stakeholder categorisation in this research counteracted the potential absorption of power asymmetries in the backcasting workshop by ensuring a balanced representation of stakeholder groups. However, it was found that stakeholder categories are not always as clear

cut as presented in literature. Pre-prepared categories proved to be only partly applicable and stakeholders were found to often fall under multiple categories. This is important because biased categorisations may cause wrong conclusions being drawn from research results. For example, think about a local veterinarian who works for both, private customers and the local government. At the same time, the veterinarian also lives in the kunuku landscape, arguing from the perspective of a local resident. Following the proposed categorisation of Durham et al. (2014), this stakeholder can be categorized as business actor, governmental actor and the local resident. Classifying stakeholder was less an issue within the stakeholder categorisation, where stakeholder categories were created by grouping the actors named by interviewees, but more within the Prospex-CQI method that was applied to set participation guidelines for the backcasting workshop. Here, the differentiation between business actors, land owners and local citizens was partly arbitrary.

Another potential source of bias that can supported the persistence of power asymmetries within this research is the conducted stakeholder categorisation, which meant to allow a prioritisation of especially vulnerable and powerful stakeholders in the engagement process. Firstly, stakeholders might refrain from giving a low ranking to other stakeholders, avoiding discreditation of befriended groups. This might explain the high levels of expertise among stakeholders found in this research. Secondly, stakeholders might strategically rank other stakeholders in attempts to promote like-minded stakeholders while downranking stakeholders with opposing perspectives. Such strategic behaviour, however, did not surface during this study.

Lastly, snowball sampling can also introduce power asymmetries. As in this research, were local policy makers were interviewed first, powerful actors are likely to be the starting point of a snowball sampling process. Therefore, those actors can steer the sampling procedure in a significant way, potentially excluding unconventional or even unfavourable voices. (Woodley & Lockard (2016) call this phenomenon a gatekeeper bias. Furthermore, it is important to realise that snowball sampling does not guarantee a representative outcome. In this study, it led to a significant gender imbalance in the workshop, one of the major weaknesses of the conducted backcasting. A potential reason for this imbalance may be that agriculture, the overarching topic in the kunuku landscape, is a male dominated domain. For example, in 2016 only 29% of farms in the EU were managed by a woman (European Commission - Directorate-General for Agriculture and Rural Development, n.d.). Whether a similar proportion holds true for Bonaire cannot be said. To enhance the transparency of the snowball sampling procedure of this study, Figure 10 shows the stakeholder network that resulted through the sampling process.

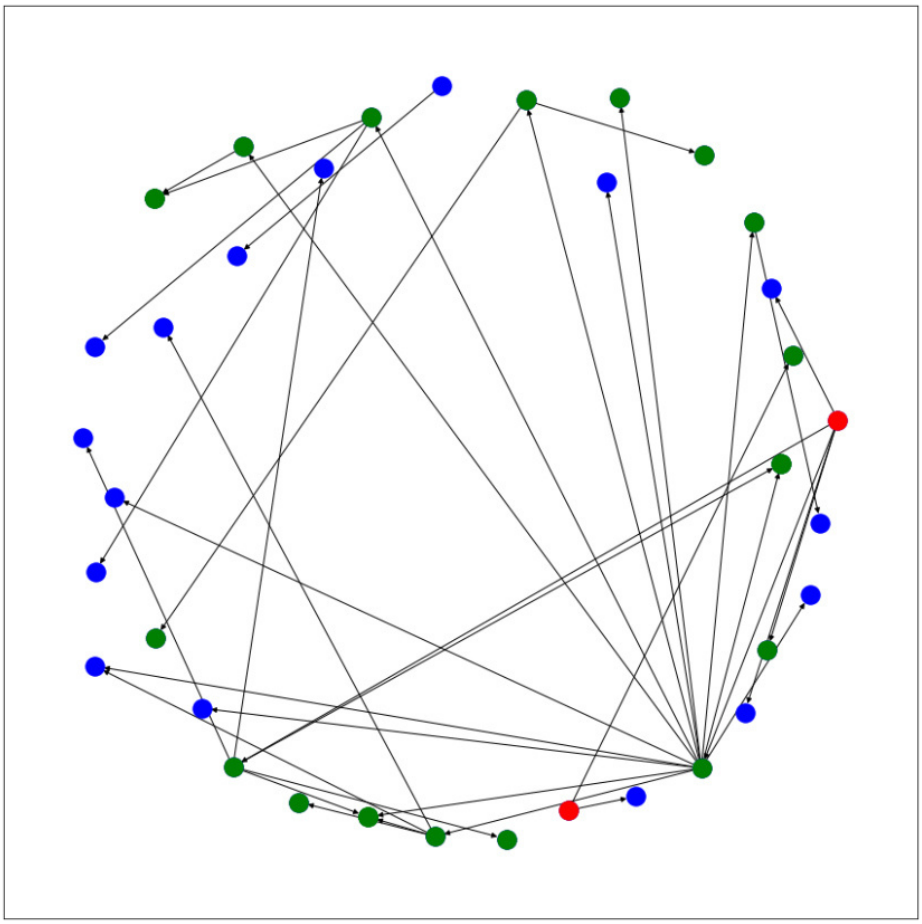

Figure 10: The stakeholder network generated through snowball-sampling. Each nod represents a stakeholder. Directed arrows show how stakeholders named each other. Red nods symbolise the two starting points for the snowball-sampling. Green nods indicate an interaction during the research project. Blue nods represent stakeholders that where either not contacted or not available for this study.

In the graph, each nod represents a stakeholder. Arrows between nodes display the naming process, with the arrowhead pointing towards the named stakeholder. From Figure 10 it becomes apparent that the snowball sampling had two starting points and that two iterations of snowballing were conducted. Furthermore, this simple graph already indicates that, while most stakeholders named only one or two, a few stakeholders named disproportionately many stakeholders. This may indicate a bias towards these stakeholders. Amongst others, such graphs could be improved in readability by making nodes bigger if they feature many connections.

Potential biases in the procedures described above are especially worrisome when thinking about their broader implications for the research results. As in this study, research that actively engages with stakeholders regularly claims higher legitimacy for its findings. This is based on the underlying assumption that transdisciplinary research is somewhat connected to democratic ideals and to a certain extent reflects perspectives, preferences and values of 'the people'. It is therefore concerning that scientific methods are prone to the systematic introduction of biases. Especially in scientific future imaginations, transparent reporting on patterns of ex- and inclusion is crucial to understand who's future is actually portrayed.

Eventually, reflecting on the concept of co-creation of knowledge, it should be noted that the important first stage, co-design, was not conducted in this research. This implies that the orientation of the research was defined by the researcher, not the stakeholders. Co-design would have empowered stakeholders to determine the scope of the research as well as to formulate research questions in a way that they are relevant to them. However, this research did not roughly dictate the problem framing. The kunuku landscape was chosen as focus point of this research in coordination with a researcher with years of experience on Bonaire. The objective was to design the research in a way that it is interesting and relevant to local stakeholders, foremost to motivate participation. Next to that, stakeholders were able to critically influence the research orientation through the snowball sampling and the stakeholder categorisation. Furthermore, stakeholders reshaped the scope of the research. While the initial understanding of the kunuku landscape was based on the delineation of Verweij et al. (2020), stakeholders pushed the research towards understanding the kunuku landscape as all the agricultural area defined in Bonaire's spatial plan (see Scope).

Improving foresight processes & anticipatory governance

If expectations create reality, how can transdisciplinary science help us dreaming?

By applying a novel analytical framework, this research shed a light on the processes of the kunuku foresight.

The visioning exercise is part of a larger project to explore the role of stakeholders in nature-inclusive transitions. It succeeded in its initial purpose to include stakeholders in the spatial planning of nature-inclusive measures. Scientific and expert knowledge as well as NGOs set the tone in this visioning process. Lay knowledge was largely excluded.

The interaction with the future was uncoordinated and not planned for. This does not mean that no conceptualisation took place. The quantitative presentation of environmental and social trends on Bonaire drew a picture of a knowledgeable future – a business as usual scenario. This indicates that the workshop was centred around the idea of probable futures. Assessing the future with an emphasis on probability is the first approach described by Muiderman et al. (2020), which seeks to inform strategic policy planning. This aligns with the fact that workshop participants effectively engaged in planning the implementation of nature inclusive measures. Understanding foresights as systematic and *deliberate* interactions with the future, it can be debated whether this visioning actually constitutes a foresight activity. At the same time, this result raises questions about whether only intentional interactions with the future should be considered a foresight. As shown, a conceptualisation of the future takes place either way.

The rather spontaneous inclusion of interviews in the visioning process counteracted the workshop's contribution to reduce ambiguity. Interviewees are not directly confronted with the frames of other stakeholders and escape the pressure of defending their line of argumentation. Thereby, the ex-post integration of interviews reduced the argumentative and social role of the visioning process. To fully assess the reflective role of this process, a

greater understanding of the pre-formulated nature-inclusive measures is necessary. In the case a majority of measures were inherently linked to certain landscapes, for example rooftop-rain water harvesting in urban areas and coral restauration in coastal areas, the workshop might have partly resembled a matching exercise, not creatively challenging participants.

The backcasting exercise brought together affected and affecting stakeholders to collaboratively design specific actions to reach the 2050 kunuku vision. In contrast to the visioning process, not a nature-inclusive but a sustainable and landscape was aspired. However, the idea of nature-inclusivity was incorporated into the backcasting process through the visions that were taken as normative end point. Because time periods for actions were not specified, it remains somewhat unclear which actions should be taken at which point in time. Nevertheless, the set of actions developed within this backcast can serve as a practical guide for future actions. Seven out of nine surveys participants argue that the local government should be informed about the results of this backcasting processes.
An important feature of the process participation is the absence of scientific knowledge. This does, however, not imply that only lay knowledge was represented. The line between lay and expert knowledge is fuzzy and subjective. Many, if not all, of the participants would have certainly attributed themselves expert knowledge in their work area. Furthermore, only one out of nine participants was a woman.
Ambiguity could have been better addressed by improving the backcasting process in numerous ways. Presentation of data regarding the kunuku landscape would have enhanced the informative role of the process. On the other hand, new information could have framed the whole process in a certain way, thereby introducing a researcher bias. For example, information on a declining vegetation cover might have caused participants to put a stronger focus on improving vegetation than usual. Next to improved facilitation through the workshop lead, asking working groups to present their five most important specific actions to each other would have promoted interaction between groups, contributing to the process' social role. Furthermore, this addition would have forced a prioritisation of actions, which was not required in the workshop because unlimited resources (e.g. unrestricted funding) are implicitly assumed within backcasts. Such prioritisation would have increased the reflective role of this backcasting process.

This study suggests that taking ambiguity into account is vital for anticipatory governance to successfully steer today's actions. No matter whether future-oriented governance processes in the present are occupied with reducing risks, structuring uncertainties, imagining new futures or exploring political implications, thereby conceptualising the future as probable, plausible, pluralistic or performative: common understanding of the present situation is key.
As described above, ambiguity is a major barrier to a shared understanding of reality. Following Dewulf & Biesbroek (2018), there are two major strategies to handle ambiguity. 'Go-alone' strategies aim to reduce the variety of frames at play to someone's own advantage. In the realm of anticipatory governance this, for example, includes unilaterally defining future risks or single-handedly determining an aspired vision. 'Concerted' strategies, on the other hand, acknowledge and actively work with a multitude of frames instead of trying to reduce them. Combining social learning and negotiation, these strategies aim to create a common understanding that enables concerted action. Due to the sensitivity and centrality of the subject, the latter strategy is more appropriate in the context of anticipatory

governance. Therefore, referring to wording from Allain & Salliou (2022), this research calls for understanding anticipatory governance as 'opening-up' and not 'closing-down' processes that are naturally based on transdisciplinarity.

Recommendations & Conclusion

Overall, this research has shown that a thematic analysis can be a valuable method to identify ambiguity. The proposed analytical framework allowed to scrutinise the processes involved in the kunuku foresight in detail. The stakeholder-driven stakeholder categorisation successfully described the social network attached to the kunuku landscape. Moreover, this study provides evidence that participatory backcasts that rely heavily on non-scientific knowledge can produce a great list of actions to reach a certain future state. In this sense, scientific knowledge is not a requirement for a successful participatory backcast.
From a broader perspective, the interdisciplinary approach taken in this study by combining research methods and concepts from the fields of political science and environmental science showcases that theoretical and practise-oriented contributions do not exclude each other. On the contrary, integration of scientific disciplines enables a more holistic understanding of the researched subject. Scrutinizing the visioning exercise that resembles the backbone of the backcast, for instance, allowed to understand and disclose the interplay between the different parts of the kunuku foresight. Even more, social science scrutiny of pragmatic environmental science research allowed new considerations to surface and provided new possibilities for critique and therefore improvement.
However, integration was limited to a conceptual level. The two general research questions each lean towards different scientific disciplines, calling for different research methods. In this sense, integration did not take place within the individual research activities. This is a clear call for the creation and establishment of truly interdisciplinary methods. For example, it should be self-understood that equal importance is given to recording, analysing and discussing the process and output of foresight processes.

Multiple recommendations are derived from the discussion above.
Regarding the formalisation of ambiguity, this this research recommends to not blindly favour modelling over storytelling approaches, but to carefully balance advantages and disadvantages in each context.
The extended analytical framework clearly showed that participants of foresights need to be challenged to take on roles of collective deliberations and mitigate the impact of ambiguities. Participants are required to engage in demanding activities such as to justifying and defending assumptions, reflecting on their own preferences and interacting with new information and contrasting opinions. Creating a safe and comfortable environment is therefore of utmost importance. Moreover, data collection on the process of foresights is essential. Foresight organisers carry the main responsibility for recording basic information regarding funding, objectives, participants and methods. Information provided by participants of foresight processes allows to triangulate and validate the information provided by foresight organisers.
Furthermore, this study offers three recommendations for improving backcasts.
Firstly, it may be helpful to explicitly differentiate between actions that can be taken on an institutional- and an individual level within the brainstorm. Doing so should result in more actions that can be taken on an individual basis, empowering individuals to contribute to reaching the end point. Moreover, backcasts might want to undertake increasing efforts to

facilitate the imagination of future opportunities, helping participants to focus stronger on the positive. Thirdly, backcasting would profit from a prioritisation of actions through participants. This might enhance the reflective role of the backcasting process and facilitate the communication of results.
To counter the shortcomings of stakeholder categorisations, short qualitative descriptions of the occupations of stakeholders may be beneficial. This may this increase the transparency and verifiability of categorisations. To hedge against biases in stakeholder-driven stakeholder categorisations, this research suggests that it is vital to ensure a sufficiently high number of participants in the process. Lastly, it is useful to conventionally provide more information about snowball sampling procedures.

Scientific imaginations of the future are trending and can be a critical piece of the puzzle for a successful transition towards a sustainable human society. The more relevant scientific foresights become, the more important it is to professionalise their implementation, broadly discuss codes of conduct and create a scientific understanding for the implications of procedural and methodological choices made. At the same time, the buzzword "stakeholder engagement" cannot be used to sweep aside scientific responsibilities regarding validity and replicability. Scientific foresight processes need to stay criticisable. Science cannot only help tackling ambiguity, knowledge generation can also reinforce it. It simply matters how a foresight process is designed and who precisely is participating in which form in it. Therefore, a major challenge for future scientific work is the standardised collection of foresight process-related information. If science wants contribute to the imagination of sustainable futures, adequate theoretical backing of its practises is fundamental.

How
do we
draw the line
between science and science
fiction?

References

Allain, S., & Salliou, N. (2022). Making differences legible: Incommensurability as a vehicle for sustainable landscape management. *Ecological Economics*, *191*(September 2021), 107240. https://doi.org/10.1016/j.ecolecon.2021.107240

Best, J. (2008). Ambiguity , Uncertainty , and Risk : Rethinking Indeterminacy. *International Political Sociology*, *2*, 355–374.

Board of Directors Bonaire. (2019). *Bonaire Board Programme 2019 - 2023*.

Börjeson, L., Höjer, M., Dreborg, K. H., Ekvall, T., & Finnveden, G. (2006). Scenario types and techniques: Towards a user's guide. *Futures*, *38*(7), 723–739. https://doi.org/10.1016/j.futures.2005.12.002

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., Clarke, V., & Terry, G. (2019). Thematic Analysis. In *Handbook of Research Methods in Health Social Sciences* (pp. 843–860). Springer Nature Singapore. https://doi.org/10.4135/9781412986281.n339

Broman, G. I., & Robèrt, K. H. (2017). A framework for strategic sustainable development. *Journal of Cleaner Production*, *140*, 17–31. https://doi.org/10.1016/j.jclepro.2015.10.121

Brugnach, M., Dewulf, A., Henriksen, H. J., & van der Keur, P. (2011). More is not always better: Coping with ambiguity in natural resources management. *Journal of Environmental Management*, *92*(1), 78–84. https://doi.org/10.1016/j.jenvman.2010.08.029

Brugnach, M., & Ingram, H. (2012). Ambiguity: The challenge of knowing and deciding together. *Environmental Science and Policy*, *15*(1), 60–71. https://doi.org/10.1016/j.envsci.2011.10.005

Bulkeley, H., & Mol, A. P. J. (2003). Participation and environmental governance: Consensus, ambivalence and debate. *Environmental Values*, *12*(2), 143–154. https://doi.org/10.3197/096327103129341261

Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jäger, J., & Mitchell, R. B. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences of the United States of America*, *100*(14), 8086–8091. https://doi.org/10.1073/pnas.1231332100

de Bruin, J. O., Kok, K., & Hoogstra-Klein, M. A. (2017). Exploring the potential of combining participative backcasting and exploratory scenarios for robust strategies: Insights from the Dutch forest sector. *Forest Policy and Economics*, *85*(June), 269–282. https://doi.org/10.1016/j.forpol.2017.06.007

de Jong, C. E., & Kok, K. (2021). Ambiguity in social ecological system understanding: Advancing modelling of stakeholder perceptions of climate change adaptation in Kenya. *Environmental Modelling and Software*, *141*(April), 105054. https://doi.org/10.1016/j.envsoft.2021.105054

Dewulf, A., & Biesbroek, R. (2018). Nine lives of uncertainty in decision-making: strategies for dealing with uncertainty in environmental governance. *Policy and Society*, *37*(4), 441–458. https://doi.org/10.1080/14494035.2018.1504484

Dryzek, J. S., List, C., British, S., Science, P., & Jan, N. (2003). *Social Choice Theory and Deliberative Democracy : A Reconciliation Linked references are available on JSTOR for this article : Social Choice Theory and Deliberative Democracy : A*. *33*(1), 1–28. https://doi.org/10.1017/S000712340300001

Durham, E., Baker, H., Smith, M., Moore, E., & Morgan, V. (2014). The BiodivERsA Stakeholder Engagement Handbook. In *BiodivERsA*.

European Commission - Directorate-General for Agriculture and Rural Development. (n.d.). *Females in the field*. 08-03-2021. Retrieved May 24, 2022, from https://ec.europa.eu/info/news/females-field-more-women-managing-farms-across-europe-2021-mar-08_en

Falconi, S. M., & Palmer, R. N. (2017). An interdisciplinary framework for participatory modeling design and evaluation—What makes models effective participatory decision tools? *Water Resources Research*, *53*, 1625–1645. https://doi.org/10.1002/2016WR019373

Frith, H., & Gleeson, K. (2004). Clothing and Embodiment: Men Managing Body Image and Appearance. *Psychology of Men and Masculinity*, *5*(1), 40–48. https://doi.org/10.1037/1524-9220.5.1.40

Fuerth, L. S. (2009). Foresight and anticipatory governance. *Foresight*, *11*(4), 14–32. https://doi.org/10.1108/14636680910982412

Giordano, R., Brugnach, M., & Pluchinotta, I. (2017). Ambiguity in Problem Framing as a Barrier to Collective Actions: Some Hints from Groundwater Protection Policy in the Apulia Region. *Group Decision and Negotiation*, *26*(5), 911–932. https://doi.org/10.1007/s10726-016-9519-1

Gomi, K., Ochi, Y., & Matsuoka, Y. (2011). A systematic quantitative backcasting on low-carbon society policy in case of Kyoto city. *Technological Forecasting and Social Change*, *78*(5), 852–871. https://doi.org/10.1016/j.techfore.2011.01.002

Gramberger, M., Zellmer, K., Kok, K., & Metzger, M. J. (2015). Stakeholder integrated research (STIR): a new approach tested in climate change adaptation research. *Climatic Change*, *128*(3–4), 201–214. https://doi.org/10.1007/s10584-014-1225-x

Guston, D. H. (2014). Understanding 'anticipatory governance.' *Social Studies of Science*, *44*(2), 218–242.

Habegger, B. (2010). Strategic foresight in public policy: Reviewing the experiences of the UK, Singapore, and the Netherlands. *Futures*, *42*(1), 49–58. https://doi.org/10.1016/j.futures.2009.08.002

Hajer, M., & Versteeg, W. (2019). Imagining the post-fossil city: why is it so difficult to think of new possible worlds? *Territory, Politics, Governance*, *7*(2), 122–134. https://doi.org/10.1080/21622671.2018.1510339

Herwig, U., Kaffenberger, T., Baumgartner, T., & Jäncke, L. (2007). Neural correlates of a "pessimistic" attitude when anticipating events of unknown emotional valence. *NeuroImage*, *34*(2), 848–858. https://doi.org/10.1016/j.neuroimage.2006.09.035

Hölscher, K., Frantzeskaki, N., & Jäger, J. (n.d.). *Policy Brief: Transformative pathways for a sustainable and resilient Europe - Integrated solutions to address high levels of climate change*.

IPBES. (2019). *Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. 1148. https://doi.org/https://doi.org/10.5281/zenodo.3831673

IPCC. (2021). *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.

Kok, K., de Jong, R., Hengeveld, G., & Arts, B. (2014). *INTEGRAL - Participative qualitative backcasting*.

Kok, K., van Vliet Mathijs, M., Bärlund Ilona, I., Dubel, A., & Sendzimir, J. (2011). Combining participative backcasting and exploratory scenario development: Experiences from the SCENES project. *Technological Forecasting and Social Change*, *78*(5), 835–851. https://doi.org/10.1016/j.techfore.2011.01.004

Lazebnik, J., van Eupen, M., & Verweij, P. (2022). *The State of cactus fences and kunukus for nature inclusivity on the island of Bonaire*.

Major, E., Asch, D., & Cordey-Hayes, M. (2001). Foresight as a core competence. *Futures*, *33*(2), 91–107. https://doi.org/10.1016/S0016-3287(00)00057-4

Mauser, W., Klepper, G., Rice, M., Schmalzbauer, B. S., Hackmann, H., Leemans, R., & Moore, H. (2013). Transdisciplinary global change research: The co-creation of knowledge for sustainability. *Current Opinion in Environmental Sustainability*, *5*(3–4), 420–431. https://doi.org/10.1016/j.cosust.2013.07.001

Muiderman, K., Gupta, A., Vervoort, J., & Biermann, F. (2020). Four approaches to anticipatory climate governance: Different conceptions of the future and implications for the present. *Wiley Interdisciplinary Reviews: Climate Change*, *11*(6), 1–20. https://doi.org/10.1002/wcc.673

Muiderman, K., Zurek, M., Vervoort, J., Gupta, A., Hasnain, S., & Driessen, P. (2022). The anticipatory governance of sustainability transformations: Hybrid approaches and dominant perspectives. *Global Environmental Change*, *73*(January), 102452. https://doi.org/10.1016/j.gloenvcha.2021.102452

Nenquimo, N. (2020, October 12). This is my message to the western world – your civilisation is killing life on Earth. *The Guardian*. https://www.theguardian.com/commentisfree/2020/oct/12/western-worldyour-civilisation-killing-life-on-earth-indigenous-amazon-planet

Newig, J., Challies, E. D., Jager, N. W., Kochskaemper, E., & Adzersen, A. (2018). The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms. *Policy Studies Journal*, *46*(2), 269–297.

https://doi.org/10.1111/psj.12209

Newig, J., & Fritsch, O. (2009). Environmental governance: Participatory, multi-level - And effective? *Environmental Policy and Governance*, *19*(3), 197–214. https://doi.org/10.1002/eet.509

Openbaar Lichaam Bonaire. (n.d.). *Ruimtelijk ontwikkelingsplan Bonaire*. 08-10-2010. Retrieved June 14, 2022, from https://www.bonaire-ro.nl/bestemmingsplannen/ruimtelijk-ontwikkelingsplan-bonaire/

Parviainen, T., Lehikoinen, A., Kuikka, S., & Haapasaari, P. (2019). Risk frames and multiple ways of knowing: Coping with ambiguity in oil spill risk governance in the Norwegian Barents Sea. *Environmental Science and Policy*, *98*(December 2018), 95–111. https://doi.org/10.1016/j.envsci.2019.04.009

Pereira, L., Sitas, N., Ravera, F., Jimenez-Aceituno, A., & Merrie, A. (2019). Building capacities for transformative change towards sustainability: Imagination in Intergovernmental Science-Policy Scenario Processes. *Elementa: Science of the Anthropocene*, *7*. https://doi.org/10.1525/elementa.374

Pluchinotta, I., Salvia, G., & Zimmermann, N. (2022). The importance of eliciting stakeholders' system boundary perceptions for problem structuring and decision-making. *European Journal of Operational Research*, *xxxx*. https://doi.org/10.1016/j.ejor.2021.12.029

Ramírez, R., & Selin, C. (2014). Plausibility and probability in scenario planning. *Foresight*, *16*(1), 54–74. https://doi.org/10.1108/FS-08-2012-0061

Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, *141*(10), 2417–2431. https://doi.org/10.1016/j.biocon.2008.07.014

Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C. H., & Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, *90*(5), 1933–1949. https://doi.org/10.1016/j.jenvman.2009.01.001

Renn, O. (2006). Participatory processes for designing environmental policies. *Land Use Policy*, *23*(1), 34–43. https://doi.org/10.1016/j.landusepol.2004.08.005

Rose, S. (2021, March 20). 'Our biggest challenge? Lack of imagination': the scientists turning the desert green. *The Guardian*. https://www.theguardian.com/environment/2021/mar/20/our-biggest-challenge-lack-of-imagination-the-scientists-turning-the-desert-green

Secretariat of the Convention on Biological Diversity. (2020). *Global Biodiversity Outlook 5*.

Swart, R. J., Raskin, P., & Robinson, J. (2004). The problem of the future: Sustainability science and scenario analysis. *Global Environmental Change*, *14*(2), 137–146. https://doi.org/10.1016/j.gloenvcha.2003.10.002

van Notten, P. W. F., Rotmans, J., van Asselt, M. B. A., & Rothman, D. S. (2003). An updated scenario typology. *Futures*, *35*(5), 423–443. https://doi.org/10.1016/S0016-

3287(02)00090-3

Veland, S., Scoville-Simonds, M., Gram-Hanssen, I., Schorre, A. K., El Khoury, A., Nordbø, M. J., Lynch, A. H., Hochachka, G., & Bjørkan, M. (2018). Narrative matters for sustainability: the transformative role of storytelling in realizing 1.5°C futures. *Current Opinion in Environmental Sustainability*, *31*, 41–47. https://doi.org/10.1016/j.cosust.2017.12.005

Vergragt, P. J., & Quist, J. (2011). Backcasting for sustainability: Introduction to the special issue. *Technological Forecasting and Social Change*, *78*(5), 747–755. https://doi.org/10.1016/j.techfore.2011.03.010

Vervoort, J., Bendor, R., Kelliher, A., Strik, O., & Helfgott, A. E. R. (2015). Scenarios and the art of worldmaking. *Futures*, *74*, 62–70. https://doi.org/10.1016/j.futures.2015.08.009

Vervoort, J., & Gupta, A. (2018). Anticipating climate futures in a 1.5 °C era: the link between foresight and governance. *Current Opinion in Environmental Sustainability*, *31*(February), 104–111. https://doi.org/10.1016/j.cosust.2018.01.004

Verweij, P., Cormont, A., Nel, J., De Rooij, B., Jones-Walters, L., Slijkerman, D., Soma, K., & Van Eupen, M. (2020). *A nature inclusive vision for Bonaire in 2050*. 46. www.wur.eu/environmental-research

Voros, J. (2003). A generic foresight process framework. *Foresight*, *5*(3), 10–21. https://doi.org/10.1108/14636680310698379

Woodley, X. M., & Lockard, M. (2016). Womanism and snowball sampling: Engaging marginalized populations in holistic research. *Qualitative Report*, *21*(2), 321–329. https://doi.org/10.46743/2160-3715/2016.2198

Wyborn, C., Davila, F., Pereira, L., Lim, M., Alvarez, I., Henderson, G., Luers, A., Martinez Harms, M. J., Maze, K., Montana, J., Ryan, M., Sandbrook, C., Shaw, R., & Woods, E. (2020). Imagining transformative biodiversity futures. *Nature Sustainability*, *3*(9), 670–672. https://doi.org/10.1038/s41893-020-0587-5

Appendix

Item list: semi-structured interview for RQ 1.2

Check whether interviewee participated in visioning workshop

- Please tell me: in which way did you participate in the creation of the landscape-specific visions for Bonaire 2050?

Questions adapted from the proposed questions by Vervoort & Gupta (2018, p. 107):

  - Why do you think was the workshop undertaken?
  - What do you think were the aims and desired outcomes of the workshop's process?
  - Can you tell me who was initiating/ chairing the workshop?
  - Can you describe broadly who was participating in the workshop?
  - Do you perceive any dynamics of representation and inclusion/ exclusion related to participation in the workshop?
  - Within the workshop: How do you think was the future conceptualised in terms of knowability? E.g. was the future considered to be certain/ knowable or uncertain/ unknowable?
  - Within the workshop: How do you think was the future conceptualised in terms of manageability? E.g. was it considered to manageable/ influenceable or uncontrollable?
- How would you describe the presented relationship between the future and the present in the workshop?
- I assume that participants had contrasting perspectives on what the future might hold. What different futures were imagined during the visioning workshop?
- From the diverse futures that were imagined during the workshop, what futures were seen as plausible? Which were understood as implausible? Who made these decisions?
- Are you personally satisfied with the result of the workshop (i.e. the vision for Bonaire 2050)?
- What do think are the implications on the present of the created visions?
- To what extend do you think can the visions influence (political) decision-making on the island?

Evaluation of interview

We now reach the end of the interview. Thank you very much for your participation and time. Before we end, I would love to have your comment on the interview itself.

- Do you feel that you were able to express your perspectives during the interview?
- Do you have any suggestions on how to improve the interview?

Item list: semi-structured interview for RQ 1.1 and RQ 2.1

- What is your connection to Bonaire? Since when are you living on the island and what is your occupation here?

General problem understanding

- Can you tell me more about the key features/ characteristics of the kunuku landscape to the East of Kralendijk (show on map) and about its importance for Bonaire?
- What are your interests regarding the kunuku landscape?
- Do you feel that you in any way depend on changes in the landscape?
- What do you think are the major problems that Bonaire, and especially the kunuku landscape, is facing?
- And what do you think causes these problems? What are the main drivers of change in the kunuku landscape?
- Now that we focused on problems, challenges and root causes, I would like to ask you how you envision potential solutions for those problems?

Stakeholder analysis

- Broadly, who do you think are the most important stakeholders on the island regarding the kunuku landscape considering …
  - expertise? (possession of specific knowledge)
  - influence? (possession of specific power)
  - dependency? (feature of special vulnerability)
- Let us now quickly go through the stakeholders you just named. For each stakeholder, please indicate how high you would rank each stakeholder feature with respect to the kunuku landscape. The available ranks are low, medium and high.

Naming people (snowballing)

- Who do you concrete think I should contact for further interviews of this kind? Which names come to your mind and could you provide me with an email-address/ phone number?

Evaluation of interview

We now reach the end of the interview. Thank you very much for your participation and time. Before we end, I would love to have your comment on the interview itself.

- Do you feel you were able to express your perspectives?
- Do you have any suggestions on how to improve the interview?

Stakeholder categorisation

Table 5: Result of stakeholder categorisation. Numbers show the average rank of stakeholder groups. Abbreviations: KvK (Kamer van Koophandel en Nijverheid) = Chamber of Commerce; LNV (Ministerie van Landbouw, Natuur en Voedselkwaliteit) = The Dutch Ministry of Agriculture, Nature and Food Quality; LVV (landbouw-veeteelt-en-visserij) = local department for agriculture, animal husbandry and fisheries; OLB (Openbaar Lichaam Bonaire) = the local government; STINAPA (Stichting Nationale Parken Bonaire) = environmental NGO; TCB = Tourism Corporation Bonaire; WEB (Water- en Energiebdrijf Bonaire) = local water and energy provider.

Grouped Stakeholders	Expertise	Influence	Dependency
Academic Dutch Expats	3.000000	3.000000	1.000000
KvK	2.500000	2.000000	2.000000
Civil Leaders	2.500000	2.750000	2.500000
Credit Institutions	3.000000	3.000000	1.000000
Dutch Government	3.000000	3.000000	1.000000
LNV	2.500000	3.000000	2.500000
Echo	2.750000	2.000000	1.500000
Elderly Residents	3.000000	1.000000	3.000000
Fishermen & Divers	2.000000	1.500000	2.500000
Hardware Stores	1.500000	2.000000	1.500000
Kriabon	1.666667	2.166667	2.600000
Kunukeros	2.166667	1.166667	2.333333
Kunuku-related Businesses	2.875000	2.000000	1.500000
LVV	2.500000	2.428571	1.666667
Local Entrepreneurs	2.500000	1.500000	3.000000
OLB	1.888889	2.888889	1.444444
Mangrove Maniacs	3.000000	1.000000	2.000000
Private Landowner	2.000000	2.000000	3.000000
Professional farms	2.000000	1.500000	3.000000
Residents	1.000000	2.000000	2.250000
STINAPA	3.000000	1.750000	1.500000
Schools	2.000000	2.000000	1.000000
TCB	2.500000	2.000000	1.500000
Traditional Knowledge Keepers	3.000000	1.625000	1.500000
WEB	1.000000	3.000000	1.500000

Specific actions

Table 6: Specific actions that constitute the three pathways towards a sustainable kunuku landscape on Bonaire by 2050. Abbreviations: OLB (Openbaar Lichaam Bonaire) = the local government; WEB (Water- en Energiebdrijf Bonaire) = local water and energy provider; LVV (landbouw-veeteelt-en-visserij) = local department for agriculture, animal husbandry and fisheries; ROB (Ruimtelijk Ontwikkelingsplan Bonaire; Spatial Development Plan Bonaire) = referring to the local spatial planning department; TCB = Tourism Corporation Bonaire; SGB (Scholengemeenschap Bonaire) = secondary school; OCW (Onderwijs, Cultuur en Wetenschap) = Dutch Ministry of Education, Culture and Science; KvK (Kamer van Koophandel en Nijverheid) = Chamber of Commerce; LNV (Ministerie van Landbouw, Natuur en Voedselkwaliteit) = The Dutch Ministry of Agriculture, Nature and Food Quality; STINAPA (Stichting Nationale Parken Bonaire) = environmental NGO.

Pathway: Local energy production and water harvesting	
Strategy: Increased water availability	
Action	Actors
Construct a kunukero-owned wastewater plant	Kunukeros and Kriabon
Create an official department that is commissioned to govern the whole water cycle (incl. water harvesting & distribution)	OLB and Dutch government
Improve current and build better water dams	WEB, OLB and Dutch government
Develop and implement innovative water harvesting methods	ROB and LVV
Improve the usage of grey water	WEB and LVV
Start a subsidy-scheme for cisterns to enhance water retention	OLB and Dutch government
Strategy: Zero import of fossil fuels	
Action	Actors
Instal solar panels	WEB, OLB and Dutch government
Incinerate waste for electricity production	Selibon
Authorise more windmills in spatial plan	OLB
Provide guidelines and support for constructing sustainable buildings	OLB
Create technical and regulatory environment that allows individuals to supply current to public energy network	WEB
Pathway: Creation of touristic and cultural value	
Strategy: Marketing of Bonairean culture	
Action	Actors

Conduct research on previous, current and future tourists	TCB
Organise cultural workshops for tourists	TCB
Allow bed & breakfast services of local families	OLB
Offer cultural programmes and informative mini-videos about Bonaire's cultural heritage to arriving tourists	TCB
Market traditional natural landscapes, cultural sites and traditional clothing, especially during the Simadan festival	TCB
Create walking routes on the coastline	TCB
Develop a marketing plan for Bonairean culture that includes walking routes and the cultural centre Mangazina di Rei	TCB
Open mansions for tourists	House owners and OLB
Promote 'Made in Bonaire' label for Bonairean art and handcrafts	SGB, art groups and the TCB
Organise a yearly stoba (Caribbean stew) contest	TCB
Strategy: Public awareness about Bonaire's history and cultural heritage	
Action	Actors
Include local history and culture in syllabus as well as in after school programmes	Preschools, SGB and OCW
Invest in authoring books about local history	OLB and Dutch government
Develop further hills in a similar fashion to Seru Largu	Land owners and OLB
Carry out a project focusing on oral Bonairean history using a combination of websites, leaflets, books and walking routes	Schools and Mangazina di Rei Foundation
Restore old buildings	House owners
Subsidise the restoration of old traditional buildings	OLB
Develop further cultural sites in similar fashion to Lac Bay	Land owners and OLB

Lecture all beginning politicians about value of cultural heritage	Local historians
Hold classes in sewing, drawing and folklore	Cultural groups and The Young Bonaire Foundation for Youth Work (Stichting Jeugdwerk Jong Bonaire)
Pathway: Agricultural activities for a self-sufficient Bonaire	
Strategy: Accessible agricultural education	
Action	Actors
Make the studies of culinary arts and agriculture more attractive to teachers	OLB and OCW
Invest in agricultural education	OLB and OCW
Transform a part of the LVV into an educational centre	LVV
Conduct research in the nutritional value of locally-sourced foodstuff	LVV and OLB
Create a website that presents traditional and innovative recipes	Local chefs
Strategy: Enhanced cooperation	
Action	Actors
Carry out pooled bulk imports of materials and equipment	LVV and Kriabon
Facilitate the cooperation between kunukeros (incl. branding, sales, equipment, etc.)	OLB
Support the signing of contracts between kunukeros and supermarkets	KvK
Strategy: Innovative agricultural systems	
Action	Actors
Start pilot project that showcases a viable aquaponic farm	LVV and the Dutch government
Research traditional agricultural practises and techniques	Mangazina di Rei Foundation, OLB and LVV
Recruit advisors specialised on regenerative agriculture	OLB
Send delegation to Brazil to exchange knowledge and establish pilot plots	LVV, OLB and LNV
Test and establish new farming methods such as hyrdo- and aquaponics and syntropic farming	LVV
Dense vegetation cover	
Action	Actors

Record, map and improve ecosystem services on the island	STINAPA and OLB
Support local movements that contribute to ecological restoration	Echo and LVV
Initiate and lead long-term reforestation projects	STINAPA and LVV
Produce medium to high size trees	Tera Barra
Start reforestation programmes for the youth	OLB
Compile a list of local trees	BonBèrdè
Reforest native plants	Echo and locals
Invest in research regarding reforestation and tree planting methods	Echo and LVV
Integration of neighbourhoods into agricultural activities	
Action	Actors
Collaborate with group of interested citizens to start constructing sustainable houses and gardens	LVV and Dutch Ministry of Agriculture, Nature and Food Quality
Collaborate on establishing food markets	Community centres, Board of Society and Care, KvK and NGOs
Initiate agricultural activities in neighbourhoods	Neighbourhoods and OLB
Support the construction of private greenhouses	Echo and locals
Organise local markets	Echo and locals