TREE POLICY ARUBA

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by

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1. Why a tree policy

This project is part of a thesis assignment. This chapter introduces the policy project which was derived from the following request by the commissioning organization in Aruba:

"A policy document on a national level for conservation of endangered / protected, native trees. This will entail engaging different stakeholders from government to non-government levels and using obtained information to create a conservation policy to increase native tree biodiversity and mitigate threats."

1.1. Introduction

In 2011, at the UN Convention on Biological Diversity (CBD), 20 targets were established to address and mitigate biodiversity loss across the globe by 2020. Unfortunately, none of the targets were globally met. The last Convention on Biological Diversity National Report of the Kingdom of the Netherlands (2019) has shown that Aruba, a constituent country of the Kingdom of the Netherlands, only met 1 of the 20 targets (Sanders, Henkens, & Slijkerman, 2019). Considering they only met the target of creating awareness about the subject of biodiversity loss, it can be said that Aruba still has to make a greater effort to halt biodiversity loss. For this report, we will focus on Aruba.

Aruba is a Caribbean island which lays south-west of the Lesser Antilles and is part of the Leeward Antilles. It is situated north-west of Curacao, about 29 kilometres off the coast of Venezuela (Hoetink, 2022). Aruba is part of the Caribbean Islands Biodiversity Hotspot and has a rich biodiversity. The island has 3 endemic flora species and 31 endemic fauna species. Besides that 28 species have been identified as endemic to the ABC islands and 37 additional species are identified as endemic to the ABC islands, northern Venezuela and Colombia (FPNA, 2023). Aruba is about 193 square kilometres (Visit Aruba, n.d.). It has a population of about 115.000 people. The Aruban population is an ethnical mix, including people from American Indian ancestry, Dutch, Spanish and African heritage. Aruba knows lesser people of African descent than its surrounding Caribbean islands because Aruba had few slave-based plantations during colonial times (Hoetink, 2022). The main spoken languages on the island are Papiamento, English, Spanish and Dutch.

Caribbean Island Biodiversity Hotspot

Biodiversity hotspots in general hold at least 1,500 plant species found nowhere else and have lost at least 70 percent of their original habitat extent. The Caribbean Islands Hotspot comprises more than 7,000 islands, inlets, reefs and cays with a land area of 230,000 km2 scattered across 4 million km2 of sea. The island geography and complex geology of the Caribbean have created unique habitats and high species diversity, and these islands have among the highest number of globally threatened species of any hotspot in the world (Brown, et al., 2020).

The climate in Aruba is tropical semi-arid. The amount of precipitation on the island amounts to 450 millilitres a year of which most falls in the months of October to December. The island lays at the southern edge of the Caribbean hurricane belt, which means most hurricanes skip the island. It is however possible for hurricanes to affect the island or to cause tropical storms (Climates to travel, n.d.). Due to the current arid climate, xeric vegetation is predominant on Aruba, consisting mostly of typical coastal vegetation (Gobierno Aruba[iv], n.d.). The island has several vegetation types, of which most vegetation types can withstand sun, heat and drought. For example, four different types of dry evergreen formations, mangrove woodlands and hippomane woodland are found on Aruba (Stoffers, 1956). Several vegetation studies have been done on Aruba. The study referred to above was executed in 1956 for which an extensive research was carried out on all the Dutch Caribbean islands to formulate specific vegetation types spread across the islands (Stoffers, 1956). In 2011 a vegetation

mapping has been done, as part of an internship research, but only for Fundacion Parke Nacional Aruba (Willemsen, 2011), henceforth described as FPNA. More recently from January 1st 2021 until December 31st 2022, the Wageningen University & Research (WUR) carried out a project to develop a vegetation map of Aruba (WUR, 2020) which is published on http://speciesdistribution.dcbd.nl/. This online vegetation map is the most recent vegetation mapping of Aruba. Besides these field researches, in 2019 a report was written by WUR on Aruba's status concerning the United Nations (UN) Aichi targets. In this report, scientists from WUR evaluated how well Aruba (and the other Dutch Caribbean islands) were complying with the UN Aichi targets. The Aichi targets are UN targets on the protection and enhancement of worldwide biodiversity. The report unfortunately states that Aruba is not on a good course towards preserving biodiversity (Sanders, Henkens, & Slijkerman, 2019).

The economic value of nature (conservation) is considered by many a strong motivation for action. The Aruban government, in cooperation with IVM, YABI and the Wolf Company, established two reports on the value of nature for the Aruban Economy. The first report, The Economics of Ecosystems and Biodiversity, states how nature and biodiversity contribute to Aruba's entire economy. It also assesses what could be lost if nature is not properly protected (Polaszek, Lacle, van Beukering, & Wolfs, 2018). This report is often referred to as the TEEB report. The second report focuses on tourism alone and how valuable nature is to this specific sector (van Zanten, Laclé, van Duren, Soberon, & van Beukering, 2018). Both reports emphasise that in the economic context nature is extremely valuable to the island for tourism, which accounts for 88,1% of Aruba's gross domestic product (van Zanten, Laclé, van Duren, Soberon, & van Beukering, 2018), as well as for other sectors such as agriculture, medicine and culture (Polaszek, Lacle, van Beukering, & Wolfs, 2018). Besides preserving economic value, the island has another pressing reason to protect its natural resources. The Caribbean islands are amongst the world's most vulnerable places to be impacted by climate change. Higher frequency and intensity of storms, sea level rising, flooding and erosion are major threats (The Nature Conservancy, 2020).

In order to protect all vegetation types and other valuable nature, the government of Aruba formulated a law which is aimed at protecting flora and fauna on the island, the Nature Conservancy Ordinance, AB 1995 No. 2. This law includes a list of species which should be given priority (paragraph 3.3.1.1.) because they are more at risk of extinction than others. Unfortunately, there is no further national plan or policy following this law. FPNA is an Aruban-based nature conservation organisation that takes responsibility for the management of the Arikok National Park and other annexed terrestrial and marine protected areas. FPNA executes several nature protection and preservation projects as well as educating the local community and visitors on the relevance and value of nature. FPNA takes responsibility for the protection of several species of flora and fauna and within their conservation framework, they would like to address tree species as well. Hence, FPNA requested to write a policy document on a national level on the conservation of endangered/protected native tree species. Considering there are very few (mature) trees left on the island, FPNA considers all native trees in need of protection. Not only those mentioned as protected by law. This policy has been developed to support FPNA and their conservation partners and stakeholders in mitigating threats and preserving these vulnerable species that are so valuable to Aruba's nature.

This tree policy will contribute to Aruba's implementation of the United Nations Sustainable Development Goals (SDGs). This report will contribute to the following five SDGs:

- SDG 8: Good jobs and economic growth
    - Nature's major contributions to tourism, is of great value to Aruba's economy. This report will contribute to the conservation and restoration of nature, trees to be specific, and with that to the economy.
- SDG 11: Sustainable cities and communities
    - This tree policy contributed to trees on the entire island of Aruba. In the urban setting, trees will contribute to more sustainable cities. For example by offering a green solution for urban overheating.
- SDG 13: Climate action
    - Preserving and protecting trees on Aruba will contribute to carbon mitigation and with that offer a positive contribution to fighting the climate crisis.
- SDG 15: Life on land
    - At its core, this policy contributes to the 15th Sustainable Development Goals. The objective is the protection and conservation of trees. By implementing this policy, Aruba commits to the 15th SDG.
- SDG 17: Partnership for the goals (United Nations, n.d.)
    - The protection of trees requires effort from numerous partners. Therefore it will contribute to the development of these partnerships.

This document starts with an introduction to the subject, including a problem description, the scope of the research and the research questions. In paragraph two the research methods are portrayed. Paragraph three entails all the information on the island. In chapter four, the policy criteria are listed and in the final chapter the recommendations are made.

1.2. Problem Description

Aruba has a great natural capital. Multiple species occurring on Aruba are endemic and don't occur anywhere else on the planet. The species, flora as well as fauna, are under great pressure. Major threats to Aruban ecosystems currently are urban development, pollution by waste and coastal development. But there are many more threats like water pollution by chemicals, tourist activities, invasive species and climate change (Polaszek, Lacle, van Beukering, & Wolfs, 2018). The pressure of urban development is increasing rapidly because there is lots of new construction going on. Mainly for tourist attractions (Dobson, 2020).

In the past, Aruba was probably covered in dry forest vegetation (van Nooren, 2008). These days, however, that is no longer the case. Through years of resource exploitation, most of Aruba's vegetation is gone. Different tree species were cut down to use their wood for export, fuel and some construction. By the turn of the 19th till the 20th century, Aruba was already so severely exploited that there were barely any trees left. The free-roaming cattle (goats and donkeys) have made it almost impossible for new vegetation to take ground (Derix, 2016). Since then the threats to trees have not been abated. In 1997 a map of Aruba was published, that included 15 rare tree species. From this map can be derived that seven species have less than 10 individuals left on the island. And that all other species mentioned on the map have less than 50 individuals standing each, on Aruba (van der Perk, 1997). Zooming in on tree species, even more recently, the state of affairs seems more gloomy. The rapport "Inventarisatie Terrestisch Aruba" by van Belle 2003, mentions 25 tree species as some form of vulnerable (van Belle, 2003).

FPNA is protecting the natural capital of Aruba. They are responsible for about 25% of the land area on Aruba. However, they find that if only the areas they manage would contain vegetation, a lot of species on the island will become extinct. Natural resources must take place all over the island, for several species to survive. Regarding vegetation and trees, the organization keeps busy with reforestation efforts. Since the publication of the above-mentioned research, mostly pioneer species

have started to create forests. But only on FPNA grounds. To let these forests develop into vegetation types including climax species, it is of great urgency that there are still seed-baring climax species left on the island. Therefore the protection of full-grown, seed-baring trees, on Aruba is also of great importance. The amount of full-grown, seed-baring trees is not great. To keep some genetic diversity it is of great significance that from this point forward, all healthy seed-baring trees survive, to one day sprout seedlings and reforest the island. And last but not least, to benefit human needs, the protection of trees on Aruba should be a priority. Numerous studies show that being around trees is good for health-beneficial reasons. Not just because it reduces heat exposure and air pollution but also because it induces stress reduction, improves mental health and ensures attention restoration. Besides, studies show, that living around trees has a positive effect on active living and weight status (Wolf, et al., 2020).

So the problem is that there are a few full-grown trees left on Aruba, which hold great value because they are habitats to several species, they are the key to restoring nature and improving human health. The trees are under great threat of disappearing from the island. Effective protection/management of trees is necessary to ensure their survival on Aruba. However, a clear policy to reach effective protection is lacking.

1.3. Scope of the Research

The objective is the production of a policy on Aruba which protects native trees all over Aruba. The policy will address and engage different stakeholders from government to non-government levels. The obtained information will be used to create a conservation policy to enhance native tree biodiversity and mitigate threats. The commissioning organisation asked to involve and take into account three subjects in the policy document.

- Island scale
- Stakeholder involvement
- The social and political landscape

Island scale

On the island are already rules and plans in place (paragraph 3. Governance). Most of them are being imposed by bigger organizations or countries (paragraph 3.2 treaties). These plans often do not include the capacity of an island like Aruba. These plans often don't take into account the financial possibilities of the small island, the enforcement options or the local population. This policy document must be focused on a scale appropriate to the island's size.

Stakeholder involvement

A stakeholder analysis must be included in the policy document. It is important to FPNA for know who the affecting and involved parties are. The analysis must include a section on cooperation. It should include if cooperation is taking place and if there are possibilities to improve.

The social and political landscape

In FPNA's own words, Aruba is a politically charged island. The island is crowded and lots of different opinions but also a general lack of knowledge and awareness affects the general view on nature management. The policy document should involve an assessment of current laws and regulations. This assessment must not just involve the laws and regulations but should also asses their current effect. It should involve the stakeholder analysis: what is de willingness to follow the rules and regulations. It will also include a section on enforcement. An analysis of which rules are being enforced, which are not and why.

The policy document is made for Fundacion Parke Nacional Aruba but will also address and engage other governmental and non-governmental stakeholders.

1.4. Research Questions

The overall objective of the project is to implement a policy on Aruba which protects native trees on Aruba. The answers to the following research questions will lead to this objective.

Main research question: What should be the elements of a successful conservation policy, that can be used as a framework for all involved nature conservation stakeholders on the island of Aruba, to mitigate threats to native trees?

- What is the importance of the survival of trees on Aruba?
- What is the current conservation status of native trees on Aruba?
- What is the current governance on Aruba influencing the survival of native tree species?
- What stakeholders are involved with land management, and therefore with the management of native trees, on Aruba?
- What criteria should the tree policy abide by?
- What propositions can be made to better protect native trees on Aruba?

2. Method

This chapter is dedicated to the methods used for data gathering and analyses.

2.1. Methodology

To specify what information is needed, the sub-questions are divided into sub-sub questions. These sub-sub questions are smaller more concrete questions to help guide the research to the right answers. Below the sub-sub questions are portrayed under the sub-question they accompany.

- What is the importance of the survival of trees on Aruba?
- What is the current conservation status of trees on Aruba?
    - What trees occur on Aruba?
    - How do trees generally occur on Aruba?
    - What are the threats to the tree species on Aruba?
- What is the current governance on Aruba influencing the survival of tree species?
    - Which laws and regulations are in place regarding nature conservation and protection?
    - Which treaties, concerning the protection/conservation of trees, does Aruba abide by?
    - What management plans and policies are in place?
    - What is the social political landscape on Aruba, including its nuances, regarding trees?
    - How are those laws and regulations being enforced?
- What stakeholders are involved with land management, and therefore with the management of trees, on Aruba?
    - Who are the relevant stakeholders managing land areas on Aruba?
    - What are those stakeholders doing to contribute to the protection and preservation of trees and mitigating biodiversity loss?
- What criteria should the tree policy abide by?
- What propositions can be made to better protect trees on Aruba?

To construct an effective conservation policy an in-depth understanding of the current situation of different tree species on Aruba is necessary. This research will explore the current (conservation) state of specific trees and the context in which these trees occur. Therefore this policy project will be a case study. The research will mostly concern qualitative data. This is because a lot of the data will be written text, think about data on the trees' health, threats, laws and stakeholder statements. All data will be analysed to assess the current situation. Data derived from fieldwork will be primary data, this is however just a small part of the research. A lot of secondary data will be used as well for this research. Considering this research is mostly qualitative, the research needs to reckon with bias, their assumptions and interpretations. Documenting streams of thoughts and putting on record every step can help prevent this from happening (McCombes, 2023).

2.2. Methods

In this paragraph, the research methods for data collection are portrayed. A schematic overview of the research method, per sub-sub question, is given in table 1. Below the table, an explanation of the methods is given.

Table 1: Methods per research question

Sub question	Sub-sub question	Methods
What is the importance of the survival of trees on Aruba?		• Literature and documentary research
What is the current conservation status of trees on Aruba?	What trees occur on Aruba? & how do trees generally occur on Aruba?	• Literature and documentary research • Fieldwork
	What are the threats to the tree species on Aruba?	• Literature and documentary research • Fieldwork
What is the current governance on Aruba influencing the survival of tree species?	Which laws and regulations are in place regarding nature conservation and protection?	• Literature and documentary
	Which treaties, concerning the protection/conservation of trees, does Aruba abide by?	• Literature and documentary
	What management plans and policies are in place?	• Literature and documentary
	What is the social political landscape on Aruba, including its nuances, regarding trees?	• Interview
	How are those laws and regulations being enforced?	• Interview
What stakeholders are involved with land management, and therefore with the management of trees, on Aruba?	Who are the relevant stakeholders managing land areas on Aruba?	• Literature and documentary
	What are those stakeholders doing to contribute to the protection and preservation of trees and mitigating biodiversity loss?	• Literature and documentary • Interview • Power Interest analyses
What criteria should the tree policy abide by?		• Problem tree • Interview
What propositions can be made to better protect trees on Aruba?		

2.2.1. Literature and Documentary Research

A literature review was used to research the following subjects:

- Importance of trees
- What tree species occur
- What is the current governance
- What treaties does Aruba abide by
- Plans and policy

For literature and documentary research, documents on the subject were gathered to answer the matching research question. Most literature and documents was be gathered online. To compile a list of tree species a more specific method is used:

Method on compiling tree list

To be able to determine which plants are trees, it should be determined what definition of a tree is used for this policy. The Oxford Advanced American Dictionary defines a tree as “A tall plant that can live a long time. Trees have a thick central wooden trunk from which branches grow, usually with leaves on them” (Oxford Learners Dictionaries, n.d.). However, in silviculture or legal terms, tree characteristics like diameter or tree circumference are often incorporated in the definition (Bomen Stichting", n.d.). For Aruba, its woody plants are often mentioned as “big shrubs or small trees”

(Stoffers, 1956). For this policy, the choice is made to include all woody species that have been described as a tree. Big or small.

To create this list two databases were used: The Dutch Caribbean Species Register (DCSR) & The Plants Of the World Online database (POWO) were accessed. The Dutch Caribbean Species Register gives information, per species, about local name, presence and distribution, literature species are mentioned, and more. It was accessed to check if the species occurs on Aruba, and what their local names are (Naturalis Biodiversity Center, 2017). The Plants Of The World Online database gives information per species about taxonomy, general description, images and more. From the general descriptions it can be derived what possible uses a plant has and growth habits. The POWO database was consulted to see if plants were trees, shrubs or other (POWO, 2023). When a species is present on Aruba according to the DCSR and is a (small) tree according to POWO, it is added to the list.

This list was presented to employees from FPNA. Species that might have been missing were mentioned and the databases were accessed again to determine if they should be added.

Method on compiling rare tree list

To compile a species list of tree species that should receive more attention than others, multiple sources were consulted. It was chosen to compile a list, using articles about Aruban species specifically, not the IUCN red list. According to the IUCN red list, only one species on Aruba is endangered, two are near threatened and 42 are least concerned (see table 2). Also in trends, IUCN determines that at least half is stable (IUCN, 2022). This might be the case worldwide but does not match the situation on Aruba.

Table 2: IUCN status & trends of Aruban species

IUCN Status	Aruban tree species	IUCN Trend	Aruban tree species
Data Deficient	2	Unknown	7
Least Concern	42	Decreasing	9
Near Threatened	2	Stable	31
Endangered	1		
No status	14	No Trend	14

Instead, 3 local articles, specifically about the vegetation on Aruba are used. The list is compiled of species that are determined rare in these sources. Additionally, the tree species, that the Aruban Government put on the endangered species list of the Nature Conservancy Ordinance, were added to this list.

Stakeholder identification

Stakeholder identification has been done a through literature review. People who affect land use can affect trees. This includes everybody who owns private property and every company that affects land use. To include everybody who affects land, would be counterproductive because the goal is to identify a group of stakeholders that can be involved in a tree policy. Governmental stakeholders were added to the list if they are active in nature management (DNM), nature laws and regulations (Santa Rosa) or land tenure or land use (DOW & DIP). Non-governmental stakeholders were added to the list if they were described to be involved with land management (FPNA & Ban Lanta y Planta) or have an advisory role in project development (StimAruba). Just like the tree species list, this list was presented to employees from FPNA. They could complement this list.

2.2.2. Fieldwork

To map how trees manifest on Aruba and what threats can be observed, fieldwork was done. For the fieldwork, there has not been chosen for the usual sample plots of line transect (commonly used methods for tree observations) because the different areas which need to be observed are not necessarily natural areas. Residential and urban areas have to be observed and using plots or transects will not lead to an accurate description of the areas. Also, the island knows a lot of different vegetation types and there was not time enough to do vegetation recordings in all different vegetation types.

For these observations, the choice is made to do general observations based on land-use stratification. Stratification of the Spatial Development Plan with Conditions (ROPV) is used (see image 1 for a map with the stratification zones).

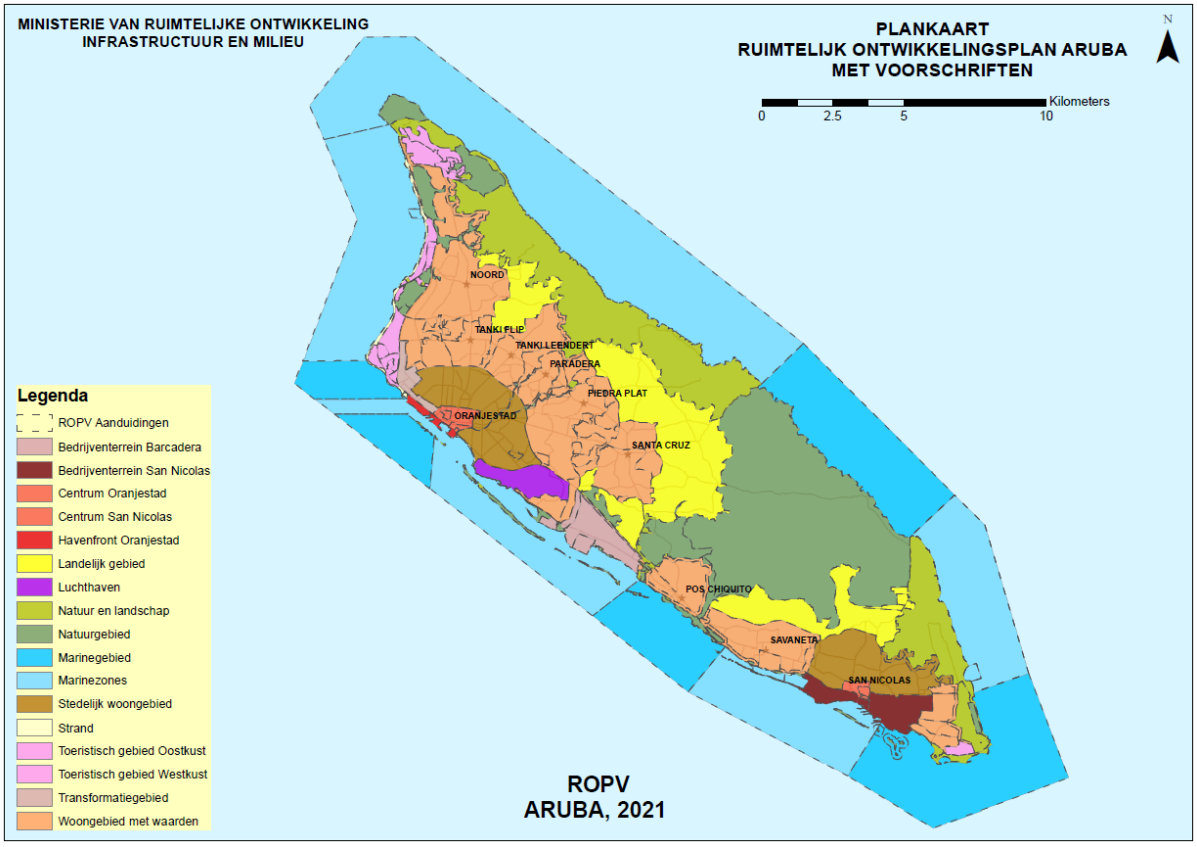


Image 1:ROPV plan map (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021)

Table 3: Observations per zone

Zone	Amount of observations
Nature reserve	8
Nature and Landscape	5
Beach	5
Urban residential area	5
Residential area with value	10
Rural area	4
Centre of Oranjestad	3
Harbour of Oranjestad	1
Centre of San Nicolas	2
West coast tourist area	3
East coast tourist area	1
Airport	1
Business park Barcadera	1
Business park San Nicolas	2
Transformation area	2

The ROPV lists 17 different zones. 15 of them were observed during the fieldwork. “Marine areas” and “marine zones” were not observed because these areas contain only water, no land area. Also, no observations were done on the coral island along the south coast, due to accessibility. Depending on the location, the islands are either part of “nature and landscape” or “nature reserve” in the ROPV. Per zone observation points were randomly chosen, to create a general picture of every zone. A total of 53 observations were done in 15 different zones. Table 3 shows how many observations were made per zone.

Per zone, a general description is made through field observations. The description will include a general description of the area if trees occur, what tree species occur and what threats to trees can be observed. To ensure the same type of data is collected from the different zones, a field form (Appendix I) is used during the observations. In Appendix II information derived from the observations can be found.

2.2.3. Interview

Interviews were used to gather information on the following subjects:

- What does the social political landscape look like on Aruba
- What does enforcement, according to nature laws, look like in practice on Aruba
- What do the stakeholders, from the stakeholder list, do for tree conservation
- Is a tree policy necessary on Aruba and what should be in it

In this research, there have been chosen to make use of semi-structured interviews to answer some exploratory research questions. The use of interviews in this research is because there are research questions which only can be answered by people’s views and opinions (Oxfam, n.d.), and not by any literature or practical research. The form of a semi-structured interview is chosen because this form of an interview can help to see patterns and leaves space open for input from others. Where a closed interview would not offer the possibility for input, and fully open interviews may not lead towards the answers needed for this research. As a method for this research, there is chosen for an in-person interview to reserve the possibility for follow-up questions and to be able to read body language. During the interviews, it is important not to ask leading questions and to avoid the risk of bias (George, 2022).

For the interviews, all stakeholders, from the stakeholder list, were approached. Six of the seven stakeholders complied by the request. An extra interviewee was interviewed because of their expertise on the seventh stakeholder. With that, information about all seven stakeholders could be derived from the interviews. Besides, all interviewees were questioned about the other subjects. They were asked about the same subjects to make it possible to compare answers. By coding the answers, views shared by multiple interviewees could be summed up (Maguire & Delahunt, 2017). In the analyses of the interviews (Appendix III) answers that are given by several interviewees are listed.

2.2.4. Power Interest Analyses

For the stakeholder analyses the power interest matrix is used. Using this analysis allows for the development of strategies in which stakeholders are managed effectively (Improvement Services, n.d.).

For the analyses, stakeholders are categorised on their level of interest and the amount of power or influence they have. The power interest grid (see image 2) makes insightful who has high or low power to affect your project, and who has high or low interest. The grid also advises on different approaches for stakeholders who end up on several places on the grid (Every, 2020).

Image 2: Power interest grid (Every, 2020)

The different approaches, advised on the power interest grid, are:

- High power - High interest: Likely to be decision-makers, they have the biggest impact. Keep these stakeholders close to manage their expectations.
- High power - Low Interest: Even though they are not interested in the outcome, they yield power. Need to be kept in the loop. These types of stakeholders should be dealt with cautiously because they could negatively use their power if they become unsatisfied.
- Low power - High interest: Can be very helpful with details in a project. Keep them adequately informed, and talk to them to ensure that no major issues will rise.
- Low power - low interest: Monitor them, but do not spend time and energy on excessive communication (Every, 2020).

2.2.5. Problem Tree

For determining the policy criteria, all information from the island description is analysed through a problem tree. A problem tree helps to find solutions by mapping out the causes and effects around an issue, in a structured manner (ODI, 2009). The advantages of using a problem tree are:

- The problem can be broken down into manageable and definable chunks. This enables a clearer prioritisation of factors and helps focus objectives.
- There is more understanding of the problem and its often interconnected and even contradictory causes. This is often the first step in finding win-win solutions.
- It identifies the constituent issues and arguments and can help establish who and what the political actors and processes are at each stage.
- It can help establish whether further information, evidence or resources are needed to make a strong case or build a convincing solution.
- Present issues - rather than apparent, future or past issues - are dealt with and identified. The process of analysis often helps build a shared sense of understanding, purpose and action (ODI, 2009).

2.3. Design of the Policy

The policy is designed by the research questions. Each research question corresponds with a research question. This is portrayed in table 4.

Table 4: Paragraph with connecting research question

Research question	Corresponding paragraph
What is the importance of the survival of trees on Aruba?	3.1 Importance of trees
What is the current conservation status of native trees on Aruba?	3.2 Conservation status of trees
What is the current governance on Aruba influencing the survival of native tree species?	3.3 Governance
What stakeholders are involved with land management, and therefore with the management of native trees, on Aruba?	3.4 Stakeholders
What criteria should the tree policy abide by?	4. Policy criteria
What propositions can be made to better protect native trees on Aruba?	5. Recommendations

3. Island Description

Chapter two consists of a description of Aruba. The four paragraphs correspond with the research questions:

3.1. What is the importance of the survival of trees on Aruba?
3.2. What is the current conservation status of native trees on Aruba?
3.3. What is the current governance on Aruba influencing the survival of native tree species?
3.4. What stakeholders are involved with land management, and therefore with the management of native trees, on Aruba?

3.1 Importance of Trees

Trees are probably the most recognizable life forms on Earth. Trees represent the largest part of Earth's biomass and they occur all over the world. They define forest distribution, composition and structure and with that provide habitat for half the world's known terrestrial plant and animal species. A great number of other species, like epiphytic plants, fungi, birds, mammals, invertebrates, amphibians, reptiles and more, depend on the presence of trees. Therefore their protection leads to enormous benefits to humans and wildlife alike (Botanic Gardens Conservation International, 2021).

Some known positive effects of trees are:

- They help combat global warming by carbon mitigation and release oxygen in the process
- They provide a habitat and food source for local fauna
- They provide shade and cool their surroundings
- They reduce soil erosion and combat desertification
- They prevent mineral washout to the sea
    - And by that prevent harm to corals
- They reduce dust and fine particles in the air
- They provide sound barriers and serve as windbreakers
- They reduce storm surge at the shore, especially the mangroves
- Trees beautify the landscape (Trees of Aruba, n.d.)

Trees are of great ecological, cultural and economic value. There is a strong link between nature and well-being (FAO and UNEP, 2020). Trees provide important cultural ecosystem services like cultural heritage, landscape beauty, social cohesion, aesthetical, spiritual, therapeutic, recreation and tourism (FPNA, 2023). Some cultural services, tourism and recreation also directly translate into economic value. On Aruba, natural capital value for tourism, culture, fishing and carbon exceeds 287,3 million US dollars per year. Tourism accounts directly for 28,6% of the total gross domestic product (GDP). Indirectly 88,1% of the GDP is made up of tourism which is expected to reach 97,4% by 2027. Natural capital assessment of tourism expenditures derives 269 million US dollars in value. Mostly due to the contribution of tourism to the national economy, small islands like Aruba depend heavily on their marine and terrestrial ecosystem services (Polaszek, Lacle, van Beukering, & Wolfs, 2018).

Trees are highly significant components of biodiversity and carbon storage. They provide this service in several ecosystems such as forests, woodlands, and grasslands, as well as artificial and urban environments (Botanic Gardens Conservation International, 2021). There is considerable evidence that the restoration of trees is among the most effective strategies in tackling the climate crisis (Bastin, et al., 2019). Ecosystems known for their abundance of tree species on Aruba are mangroves, tropical dry forests and tropical dry shrubs. On Aruba, these ecosystems stock over 1,1 million Mg of carbon. The estimated carbon sequestration, of these ecosystems, is 4.580 Mg per year. Economically, this is equivalent to about 83.858 US dollars per year (Polaszek, Lacle, van Beukering, & Wolfs, 2018).

Carbon stock on Aruba (Polaszek, Lacle, van Beukering, & Wolfs, 2018)

- Mangroves: 66.006 Mg
- Tropical dry forest: 974.400 Mg
- Tropical dry shrubs: 78.700 Mg

- Seagrass: 112.752 Mg
- Salt marshes: 61.100 MG

Carbon sequestration estimation per year (Polaszek, Lacle, van Beukering, & Wolfs, 2018)

- Mangroves: 240 Mg per year
- Tropical dry forest ecosystems: 3640 Mg per year
- Tropical dry shrubs: 700 Mg per year

- Seagrass: 870 Mg per year
- Salt marshes: 500 Mg per year

Value of carbon sequestration in 2018 (Polaszek, Lacle, van Beukering, & Wolfs, 2018)

- Mangroves: $4.363
- Tropical dry forest: $66.696
- Tropical dry shrubs: $12.799

- Seagrass: $15.900
- Salt marshes $9.226

Total: $108.983

Total from ecosystems with trees $83.858

Additionally, trees provide many other ecosystem services like water purification, erosion prevention, flood defence, air temperature control and regulation of air quality (FAO and UNEP, 2020). With the loss of tree populations, Aruba also loses these positive effects.

3.2 Conservation Status of Trees

This chapter clarifies the conservation status of trees on Aruba. The value of trees, to Aruba is highlighted here. Also, the presence of trees on the island is assessed. Understanding which trees occur on Aruba and how they are distributed on the island is necessary for composing recommendations.

3.2.1 Trees of Aruba

Historically, Aruba has been exploited through the years. In the past, Aruba was probably covered with dry tropical forests. Years of human presence on Aruba had a major impact on these forests and only fragments of different dry forest types are still present (van Nooren, 2008). The exploitation of timber knows a long history on the island. Before 1515 a population of Amerindians inhabited the island. They had little effect on the island, and reforestation by them was few. From 1515 the Spanish ruled the island and this had major effects on forests and trees. The exploitation began, and wood was a valued product. Dyewood (Haematoxylon brasiletto) and ironwoods (Guaiacum officinales) were cut a lot. Also, free grazing of cattle, mainly goats, affected the landscape. Through the years the island was also colonized by the Dutch and English and through these periods the exploitation continued. At the beginning of the 1900 Aruba was mainly used for agriculture. By this time it was described that after the continuing harvest of wood for export, construction and to fuel the furnaces of the lime kilns and phosphate ovens, most of the local trees had gone with only sparse patches

beside the agriculturally developed land (Derix, 2016). It can be said that thousand years of human impact caused large-scale deforestation and soil erosion (van Nooren, 2008).

3.2.1.1 Native trees species

For Aruba, its woody plants are often mentioned as "big shrubs or small trees" (Stoffers, 1956). With the history of the island explained above, changes are that these species do not have had the time to develop into trees. And therefore are perceived as shrubs. In The Vegetation of the Netherlands Antilles, by Stoffers (1996), 13 different vegetation types are described on Aruba. 4 seasonal formations, 4 evergreen formations and 5 edaphic communities. Names like thorny woodland, evergreen woodland and mangrove woodland all indicate woody plants, and probably trees. But also vegetation types like "desert" and "Vegetation of salt flats and Salinas" include tree species in their descriptions. At least 27 tree species are mentioned in the descriptions of Aruba's vegetation types (Stoffers, 1956). An article in StimAruba magazine, from 1997, states that there are 48 tree species occur on Aruba (Petrochi, 1997). However, an established list of tree species on Aruba does not exist. From accessing the databases it can be derived that up to 61 different native tree species can occur on Aruba. Note: this number is based on the qualification of species in the Dutch Caribbean Species Register, if these species are still alive on Aruba right now is unclear. Observation and monitoring, outside of the national park, date back over 20 years. And even those observations mention the rarity of many tree species (van der Perk, 1997) (van Belle, 2003) (Petrochi, 1997). The 61 tree species that can occur on Aruba, plus information on rarity, are listed in table 5. Some species in the table, are mentioned in literature as extinct, those are listed below the table. Besides, two species are not typical trees. Below the table these species are described.

The Vegetation of the Netherlands Antilles, Aruba (Stoffers, 1956)

Seasonal formations

- Thorny woodland [II]
- Cactus-thorn scrub [IV]
- Croton-Lantana-Cordiathicket [V]
  - Croton facies [V A]
  - Jatropha facies [V B]
- "Desert" [VI]

Dry evergreen formations

- Evergreen woodland [VII]
- Croton-Lantana-Cordia thicket [X]
  - Croton facies [X A]
  - Phyllanthus facies [X B]
  - Antirrhoea facies [X C]
- Littoral woodland [XI]
  - Coccoloba uvifera type [XI A]
  - Rhacoma crossopetalum type [XI B]
- Vegetation of the rock pavement [XII]

Edaphic communities

- Mangrove woodland [XIII]
- Herbaceous strand community [XIV]
  - Sesuvium facies [XIV A]
  - Fimbristylis facies [XIV B]
  - Sporobolus facies [XIV C]
  - Ipomoea facies [XIV C]
- Strand scrub community [XV]
  - Toumefortia facies [XV A]
  - Suriana facies [XV B]
  - Euphorbia facies [XV C]
- Hippomane woodland [XVI]
- Vegetation of salt flats and salinas [XVII]

Table 5: Tree species of Aruba

Nr.	Scientific name	Aruban name	Endangered list (Dowers, 2017)	Rare tree map (van der Perk, 1997)	Inventory Terrestrial Environment of Aruba (van Belle, 2003)	Plant species on Aruba (Petrochi, 1997)
1	Avicennia germinans	Mangel Preto	*			
2	Bontia Daphnoides	Oleifi				
3	Bourreria succulenta	Mata di Yuana/Watakali				
4	Bursera karsteniana	Palisia Blanco/Pal'i Siya Cora	*			
5	Bursera simaruba	Palisia Cora/Pal'i Siya Cora	*	*	*	Very rare
6	Bursera tomentosa	Palisia Dushi/Palu di siya dushi/ Pal'i Siya Dushi	*			Rare

7	Caesalpinia coriaria	Watapana/Dividivi				
8	Capparis flexuosa*	Stoki/Mosterd	*	*	*	
9	Capparis indica	Huliba macho	*		*	
10	Casearia tremula	Palo di Boneiro				
11	Castela erecta	Turpin	*			
12	Celtis iguanaea	Beishi di yuana/Rombèshi	*	*	*	
13	Clusia rosea		*			
14	Coccoloba swartzii	Camari				
15	Coccoloba uvifera	Druif				
16	Condalia henriquezii	Beishi/Sumpina	*			
17	Conocarpus erectus	Fofoti	*			
18	Cordia dentata	Cawara/Cawara di Mondi/Carawara/Cawara Blanco				
19	Crateva tapia	Giron/zjiron	*	*	*	Very rare
20	Crescentia cujete	Calbas Rondo/Calbas di Mondi				
21	Crossopetalum rhacoma	Beishi di Lama			*	Rare
22	Croton niveus	Kiviti				Rare
23	Erythrina velutina	Palo di Bonchi	*	*	*	Rare
24	Ficus brittonii	Mahawa	*	*	*	Very rare
25	Geoffroea spinosa	Taki	*	*	*	Very rare
26	Guaiacum officinale	Wayaca				
27	Guaiacum sanctum	Wayaca macho	*	*	*	Very rare
28	Guapira fragrans	Bembe di porko	*		*	
29	Guapira pacurero	Macubari	*			Rare
30	Haematoxylum brasiletto	Brazil	*	*		Rare
31	Handroanthus billbergii	Kibrahacha				
32	Hippomane mancinella	Mansaniya				
33	Jacquinia arborea	Mata Pisca				
34	Krugiodendron ferreum	Coushati/Caushati	*	*	*	Very rare
35	Laguncularia racemosa	Mangel	*			
36	Manihot carthaginensis	Yuca Amara/Yuca Guajira/Yuca di Mondi	*	*	*	
37	Maytenus sieberiana	Palo di Colebra	*			Very rare
38	Maytenus tetragona	Palo di Colebra	*	*	*	
39	Metopium brownei	Mansaliña macho/Mansaniya bobo/Mansaniya Macho	*	*	*	Very rare
40	Morisonia americana	Bushicuri	*	*	*	Very rare
41	Morisonia hastata					
42	Morisonia linearis	Kedebeshi				
43	Parkinsonia aculeata	Bonchi' Strena				
44	Peltophorum acutifolium	Curahout				Rare
45	Pereskia guamacho*	Afuso/Supi	*	*	*	Very rare
46	Pilocarpus goudotianus	Palu Cayente			*	
47	Pithecellobium platylobum	Huñagato/Huña huña	*		*	Rare
48	Pithecellobium unguis-cati	Pan cu Keshi/Yaga Dabaruida/Dabaruida/Huñafato Grandi/Yaga				
49	Pluchea carolinensis		*			

50	Prosopis juliflora	Kwihi			
51	Quadrella odoratissima	Huliba			
52	Rhizophora mangle	Mangel/Mangel Tam	*		
53	Schoepfia schreberi	Mata Combles	*	*	Very rare
54	Senna atomaria				
55	Senna sophera	Brusca			
56	Sideroxylon obovatum	Palo di Lechi			Rare
57	Sophora tomentosa				
58	Spondias mombin	Hoba	*		
59	Thespesia populnea	Foyo di Crus			
60	Trixis inula		*		
61	Vachellia tortuosa	Hubada			

The Dutch Caribbean Species Register mentioned that the following three species might be extinct on Aruba: Clusia rosea, Maytenus sieberian (Palo di Colebra) and Sophora tomentosa. Besides that, FPNA employees mentioned that Spondia mombin (Hoba) might be extinct as well.

Capparis flexuosa (Stoki/mosterd)

The Capparis flexuosa is described as a scrambling tree. Which would make it more of a climber/scrambler than a tree. However, the plant is added to the tree list because it is mentioned on de “Rare Tree Map” (van der Perk, 1997). In history this species is classified as a tree, and so it is now.

Pereskia guamacho (Afuso/Supi)

The pereskia Guamacho is a semi-succulent tree. The pereskia guamacho is a tree but it is not a woody tree and should be classified as a cactus. It is still added to the tree list because it is also mentioned on de “Rare Tree Map” (van der Perk, 1997). In history this species is classified as a tree, and so it is now.

From the native tree species, those mentioned as rare in literature should get a higher priority in protection than others. The endangered species list, from the government of Aruba, contains 33 tree species (Dowers, 2017). The rapport “Inventarisatie Terrestisch Aruba” by van Belle 2003, is the most recent inventory of Aruba’s flora and fauna. Van Belle describes vulnerable flora in three categories. The first category contains species of which the population is rare in numbers and/or distribution areas. The second category contains species of which the Aruban populations had declined in numbers and or distribution area since 1900. The third category consists of species which have rare distribution areas internationally speaking. In total 25 different tree species are mentioned as some form of vulnerable (van Belle, 2003). Another relevant source is the “zeldzame bomen kaart” translated to English as “rare species map”. On this map, the location of 15 tree species is shown. From this map can be derived that seven species have less than 10 individuals left and that all of them have less than 50 individuals standing on Aruba (van der Perk, 1997). Lastly, from the article “Plant species of Aruba”, it can be derived that 10 tree species are rare and 11 are very rare (Petrochi, 1997). A lot of species occur as rare in multiple sources. 10 species are even mentioned as rare in all four sources. Taking all rare trees, a list of 38 tree species is derived (table 6).

Table 6: Rare tree species

Nr.	Scientific name	Aruban name
1	Avicennia germinans	Mangel Preto
2	Bursera karsteniana	Palisia Blanco/Pal'i Siya Cora
3	Bursera simaruba	Palisia Cora/Pal'i Siya Cora
4	Bursera tomentosa	Palisia Dushi/Palu di siya dushi/ Pal'i Siya Dushi
5	Capparis flexuosa	Stoki/Mosterd
6	Capparis indica	Huliba macho
7	Castela erecta	Turpin
8	Celtis iguanaea	Beishi di yuana/Rombèshi
9	Clusia rosea	
10	Condalia henriquezii	Beishi/Sumpina
11	Conocarpus erectus	Fofoti
12	Crateva tapia	Giron/zjiron
13	Crossopetalum rhacoma	Beishi di Lama
14	Croton niveus	Kiviti
15	Erythrina velutina	Palo di Bonchi
16	Ficus brittonii	Mahawa
17	Geoffroea spinosa	Taki
18	Guaiacum sanctum	Wayaca macho
19	Guapira fragrans	Bembe di porko
20	Guapira pacurero	Macubari
21	Haematoxylum brasiletto	Brazil
22	Krugiodendron ferreum	Coushati/Caushati
23	Laguncularia racemosa	Mangel
24	Manihot carthaginensis	Yuca Amara/Yuca Guajira/Yuca di Mondi
25	Maytenus sieberiana	Palo di Colebra
26	Maytenus tetragona	Palo di Colebra
27	Metopium brownei	Mansaliña macho/Mansaniya bobo/Mansaniya Macho
28	Morisonia americana	Bushicuri
29	Peltophorum acutifolium	Curahout
30	Pereskia guamacho	Afuso/Supi
31	Pilocarpus goudotianus	Palu Cayente
32	Pithecellobium platylobum	Huñagato/Huña huña
33	Pluchea carolinensis	
34	Rhizophora mangle	Mangel/Mangel Tam
35	Schoepfia schreberi	Mata Combles
36	Sideroxylon obovatum	Palo di Lechi
37	Spondias mombin	Hoba
38	Trixis inula	

3.2.1.2 Alien tree species

Besides the native tree species, the Dutch Caribbean Species Register also included alien species. A total of 19 alien tree species are identified. In table 7 the alien tree species of Aruba are listed. Van der Burg, de Freitas, Debrot & Lotz (2012) did research and published "Naturalised and invasive alien plant species in the Caribbean Netherlands: status, distribution, threats, priorities and recommendations". In table 7 a fourth column is added which indicates if the species was mentioned in this article as exotic, established, naturalised or invasive. The textbox elaborates on what the terms "Exotic, establishes, naturalised and invasive means.

Exotic
Species that are not part of the natural indigenous vegetation are called exotics. These species are not considered problematic.

Established
Species that occur 'in the wild', *i.e.* outside the control of cultivation or husbandry and can reproduce themselves resulting in new individuals, we call established.

Naturalised
If given enough time, species may start to adapt genetically to the new environment, by optimising its physiology and/or growth habit. As a result, the species will start spreading more rapidly and effectively and becoming part of the natural flora. In most cases, this is not considered a major problem.

Invasive
They start to grow out of control, massively invade natural habitats and reduce or eliminate native species. They have broken down the dispersal barrier and have become invasive. At this stage, one can only try to achieve a stage of equilibrium, of mitigation, by intensive control measures. These are usually limited by financial resources, and can normally only be successful with the commitment of the local society (van der Burg, de Freitas, Debrot, & Lotz, 2012).

Table 7: Alien tree species of Aruba

Nr.	Scientific name	Aruban name	Status (van der Burg, de Freitas, Debrot, & Lotz, 2012)
1	Albizia lebbeck	Barba di Jonkuman	Established
2	Azadirachta indica	Nim	Invasive
3	Cordia sebestena	Karawara spaño	Exotic
4	Delonix regia		Exotic
5	Ficus microcarpa		Exotic
6	Gliricidia sepium	Ratonera	X
7	Leucaena leucocephala	Garote di San José	Invasive
8	Malpighia emarginata	Shimarucu	X
9	Mangifera indica		Exotic
10	Melicoccus bijugatus	Kenepa	X
11	Moringa oleifera	Marengo/Merengue	Naturalised
12	Psidium guajava		Exotic
13	Senna bicapsularis	Brusca Dushi	Naturalised
14	Tabebuia heterophylla		Established
15	Tamarindus indica	Tamarijn/Tamaren	X
16	Tecoma stans	Kelki hel	Invasive

17	Terminalia catappa	Almendron	X
18	Ziziphus mauritiana		Naturalised
19	Ziziphus spina-christi	Apeldam	Naturalised

Alien tree species can form a threat to native vegetation if they have broken down the dispersal barrier and become invasive. Invasive species start to grow out of control and massively invade natural habitats which results in the reduction or even the elimination of native species. Three tree species are indicated as invasive:

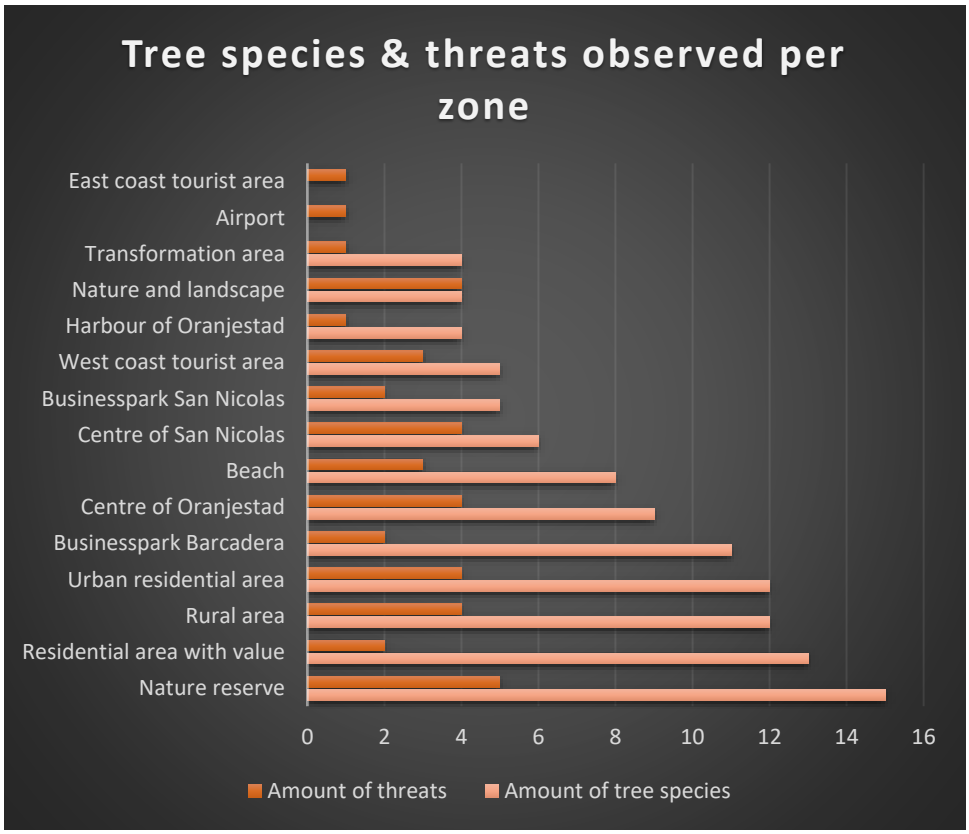
- Azadirachta indica Nim
- Leucaena leucocephala Garote di San José
- Tecoma stans Kelki hel

These tree species should be taken into account as a threat.

3.2.1.3 Trees per ROPV zone

General observations were done to observe how trees manifest on Aruba. The field observations were done based on the Spatial Development Plan with Conditions map (see paragraph 3.3.2. Spatial Development Plan (with Conditions)). An explanation of the observation and the entire analysis can be found in Appendix II. In figure 1 an overview is given with the amount of different trees and threats observed per zone. Most amount of tree species were found in the "Nature reserve" but also in "Residential area with value", "Urban residential area", "Rural area" and "Business park Barcadera". In two zones, "East coast tourist area" and "Airport", no trees were observed. The number of threats observed per zone are various.

Figure 1: Trees & threats observed per zone



The goal of the observations was to create a general view of how trees manifest per zone. From the observations it is derived that trees occur per zone as followed:

- Nature reserve: The nature reserves cannot be summarized in one general description. Big trees, small trees and big shrubs all occur within the nature reserves. In the reserves on Westpunt near the lighthouse and Saliña Noord trees barely occur. These areas are open and if tree species occur they are mostly small shrubs. In Parkietenbos and Spanish Lagoon, the forest vegetation consist of mangrove species, and in the park, a wide range of tree species can be found, as shrubs and as full-grown trees.
- Nature and landscape: The area, along the north side of the island, within the nature and landscape plots, have the same general look. Vegetation does not grow higher than approximately 1,5 meters. Closer to the coastline the vegetation cover declines and shrubs grow less high. In this area, a lot of dirt roads occur, which are being used by a lot of ATVs and UTVs (tours). The paths are not marked. Multiple paths occur parallel to each other. East-side of Arikok National Park conforms to the same view. Small nature and landscape plots also occur within other areas. A plot in the high-rise hotel area was observed, Signature Park. The general view of this area is much different from the areas on the north side. In Signature Park a dense shrub vegetation occurs.
- Beach: Beaches are in general open areas with either sand or bare rocks. Often some solitaire trees occur, useful for shade. On some beaches there are small trees and on others big full-grown trees. Surfside Beach seems to be different from the others. There the trees are covering the beach like a forest.
- Urban residential area: In the urban residential area the landscape mostly contains houses and commercial buildings. Mainly low-rise. Trees occur in green zones and sometimes as solitaire trees along the streets. Smaller green zones are often empty lots with uncultivated vegetation. Bigger green zones can be found in “rooien”.
- Residential area with value: In most areas (except for the area near Sero Colorado, observation 42) these landscapes are typical residential areas. The view is dominated by residences, trees in gardens and alongside roads and some commercial buildings. Most buildings in these areas are low-rise. Green zones sometimes occur on small lots, and sometimes contain bigger more park-like areas. The area that is different from this view, is the area in San Nicolas, south-east of Fortheuvelstraat. This area is mostly undeveloped and dominated by shrub vegetation.
- Rural area: In the rural areas a lot of forest-like/high shrub vegetation occurs. Natural areas alternate with residences, private properties and cunucu’s. From the observations, it seems like the rural areas near San Nicolas accommodate fewer private properties than the areas around Oranjestad.
- Centre of Oranjestad: The observations from the centre of Oranjestad portrays a landscape dominated by buildings. Mostly houses and commercial buildings. Trees occur mostly on private properties (gardens) or small patches. Most green is cultivated. Trees are often cultivated. A lot of trees stand solitaire on a small piece of soil, surrounded by pavement. The fact that the area is built and paved full, no natural regeneration is possible around most trees. Trees also occur on what seem to be empty lots, maybe these lots are meant for construction.
- Harbour of Oranjestad: The harbour is a partially developed (east side) area. The developed area contains lots of commercial buildings. All vegetation occurring here seems cultivated. There is low-cut grass, trimmed bushes and palm trees. On the west side, a big paved/concrete area occurs where festivals seem to be held. In the middle, a big fence

surrounds the area. In this area are undeveloped patches covered with vegetation, mainly shrubs.

- Centre of San Nicolas: The city centre of San Nicolas is mainly covered with buildings and roads. Green/vegetation occurs in small zones. Often they seem neglected/not cultivated. Also, roadsides seem less maintained. This shows in the fact that empty lots are often overrun with Garote di San Jose and Nim (shrubs).
- West coast tourist area: The tourist area on the west coast is highly developed and cultivated. In the high-rise and low-rise hotel areas, most ground is covered with buildings and infrastructure. Vegetation occurs here highly cultivated on hotel properties or as big trees alongside the road. A bit further west Tierra del Sol covers a big part of the tourist area. This is a fenced-off area which feels like a small village including a golf course. In this area a lot more vegetation occurs, but it is all cultivated. Trees occur alongside the edge of the area or highly cultivated solitaire. (on the east side of this area, which is closed off, it seems like empty lots occur for cultivation. It seems lots of shrubs occur here.) It is noticeable that roadsides and roundabouts in the tourist area seem way more cultivated/way greener than on the rest of the island.
- East coast tourist area: The tourist area on the east side is not open for visitors yet. On the west side of the area, the construction of big hotels is in development. This is a big cleared construction side. The east side is covered in vegetation. Vegetation that occurs here is not higher than 1 meter.
- Airport: There are buildings on the terrain, roads and landing strips and some low vegetation. It seems all vegetation is kept low. The vegetation seems to consist of herbs and grasses. Some very small shrub seedlings.
- Business park Barcadera: Trees were observed while driving to get a wide range of species occurring here. In this area land with shrub vegetation alternates with industrial developed land. Of the shrubland, about 70 % is covered with high shrubs and small trees. Also, some big trees occur alongside the roads.
- Business park San Nicolas: Most of the area is covered with big refinery constructions. A lot of concrete covers the area grounds. There seem to be open areas as well which are mostly covered with grasses. Occasionally big shrubs occur. Around a parking lot, it seems big trees occur.
- Transformation area: The transformation area seems to be a business park. No big industry occurs here but commercial buildings of all sorts are located here. Buildings dominate this area. Nature occurs sporadically. Either cultivated or on neglected lots.

A total of 28 tree species were listed during observations. 18 of them are native species and 10 are alien species. From table 8 can be derived which native tree species were observed per zone. From the 18 native tree species observed, 6 are on the list of rare species:

- Avicennia germinans — Mangel preto
- Bursera karsteniana — Palisia blanco
- Conocarpus erectus — Fofoti
- Crossopetalum rhacoma — Beishi di lama
- Laguncularia racemosa — Mangel
- Rhizophora mangle — Mangel tam

Mangel preto (Avicennia germinans), Mangel (Laguncularia racemosa) and Mangel tam (Rhizophora mangle) are all mangrove species. Logically these species are observed in the zones of beach and nature reserves. Because in these areas, mangroves occur or adjoin. Fofoti (Conocarpus erectus) is a tree species associated with mangroves but can also be found in other vegetations. This species was observed in the zones of beach, nature reserves and rural areas. Palisia blanco (Bursera karsteniana) was observed in the rural area and residential area with value, and Beishi di lama (Crossopetalum rhacoma) is observed in business park Barcadera. So the rare species, that were observed, occur in:

- Nature reserve 4 rare tree species observed
- Beach 3 rare tree species observed
- Rural area 2 rare tree species observed
- Business park Baracadera 1 rare tree species observed
- Residential area with value 1 rare tree species observed

From the observations became clear that rare trees mostly occur within the nature reserves. This is confirmed by the vegetation mapping of Arikok National Park, by Willemsen (2011). During this vegetation mapping, 27 tree species were observed of which 10 were from the rare species list. Over a third of all tree species observed then were rare (37%). None of them had more than 10 individuals observed (Willemsen, 2011).

The top ten trees, which were observed in most zones can be found in figure 2. Kiwhi (Prosopis juliflora) occurs in 11 of the 15 areas that were observed, this means they were observed in 73% of the areas. Other most occurring trees, according to the observations, are Druif (Coccoloba uvifera), Hubada (Vachellia tortuosa), Huliba (Quadrella odoratissima) and Nim (Azadiracha indica). Of the top ten most observed trees, three are alien species.

Figure 2: Top 10 most observed trees

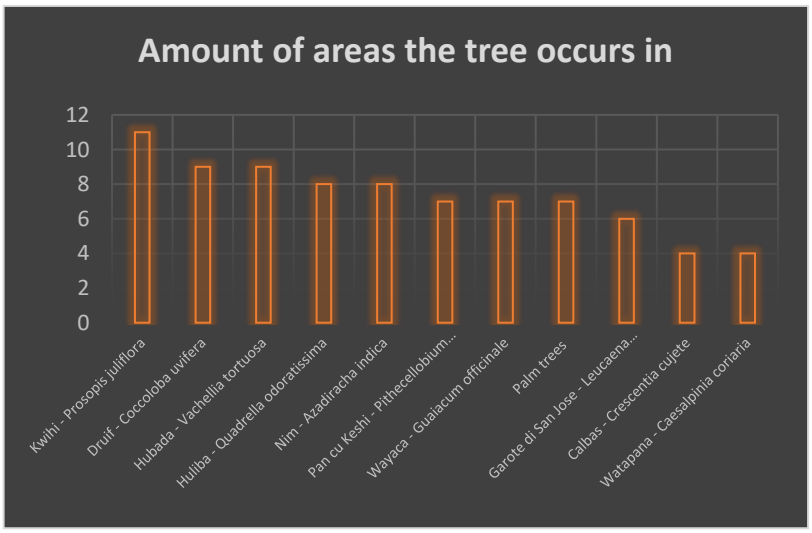


Table 8: Native trees observed per area

Scientific name:	Local name:	Nature reserve	Nature and landscape	Beach	Urban redidential area	Residential area with value	Rural area	Centre of Oranjestad	Harbour of Oranjestad	Centre of San Nicolas	West coast tourist are	East coast tourist area	Airport	Businesspark Barcadera	Business park San Nicolas	Transformation area	
Amount of areas the tree species occur in																	2
Avicennia germinans	Mangel preto	*		*													1
Bourreria succulenta	Watakeli	*															2
Bursera karsteniana	Palisia Blanco (7 individuals)					*	*										4
Caesalpinia coriaria	Watapana				*	*	*							*			9
Coccoloba uvifera	Druif	*	*	*	*	*			*		*			*	*		3
Conocarpus erectus	Fofoti	*		*			*										1
Cordia dentata	Cawara	*															4
Crescentia cujete	Calbas	*			*	*	*										1
Crossopetalum rhacoma	Beishi di Lama													*			8
Guaiacum officinale	Wayaca	*		*	*	*	*	*						*	*		1
Hippomane mancinella	Mansaniya	*															1
Jacquinia arborea	Mata Pisca													*			1
Laguncularia racemosa	Mangel	*															1
Pithecellobium anguis-cati	Pan cu Keshi	*			*	*	*				*			*		*	7
Prosopis juliflora	Kwihi	*	*		*	*	*	*		*	*			*	*	*	11
Quadrella odoratissima	Huliba	*			*	*	*	*	*		*			*	*		9
Rhizophora mangle	Mangel tam	*		*													2
Vachellia tortuosa	Hubada	*	*	*	*	*	*				*			*		*	9
Amount of tree species observed in the area:		14	3	6	8	9	9	3	2	1	5	0	0	9	4	3	

Table 9: Alien trees observed per area

Amount of areas the tree species occur in:		1	8	1	1	6	2	3	1	2	6	
Transformation area											*	1
Business park San Nicolas			*									1
Businesspark Barcadera			*			*						2
Airport												0
East coast tourist area												0
West coast tourist are											*	1
Centre of San Nicolas			*			*	*			*	*	5
Harbour of Oranjestad						*					*	2
Centre of Oranjestad		*	*	*	*				*		*	6
Rural area			*			*		*				3
Residential area with value			*			*		*				3
Urban residential area			*			*		*		*		4
Beach											*	1
Nature and landscape			*									1
Nature reserve							*					1
Local name:		Barba di Jonkuman	Nim		Karawara Spaña	Garote di San Jose	Kenepa	Morenga		Apeldam	Palm trees	
Scientific name:												
	Albizia lebbeck											
	Azadirachta indica *											
	Cordia boiserie											
	Cordia sebestena											
	Leucaena leucocephala *											
	Melicoccus bijugatus											
	Moringa oleifera											
	Tabebuia rosea											
	Ziziphus spina-christi											
Amount of tree species observed in the area:												

From table 9 can be derived which alien tree species were observed per zone. From the observed alien species trees all, except from Morenga (Moringa oleifera), can be found in a city centre ("Centre of Oranjestad" or "Centre of San Nicolas"). Nim (Azadirachta indica) is the most occurring alien species, being observed in 8 different zones. Garote di José (Leucaena leucocephala) and palm trees are the second most observed alien species, in 6 different zones. Of the most occurring alien trees, two are invasive species. Nim (Azadirachta indica) and Garote di José (Leucaena leucocephala), the invasive species were observed in:

- Urban residential area
- Residential area with value
- Rural area
- Centre of Oranjestad
- Centre of San Nicolas
- Business park Barcadera
- Business park San Nicolas
- Harbour of Oranjestad
- Nature and landscape

Both residential areas, "urban residential area" and "residential area with value", accommodate 4 different alien species. In the nature zones, "nature reserve" and "nature and landscape", alien species only occur twice. Because most species occur in city centres and residential areas, while barely any alien species were observed in nature areas, it seems the alien species thrive more in urban areas.

3.2.2 Threats

Globally the main threat to trees is the clearance of forests and other forms of habitat loss. Also, the exploitation of timber and other tree-related products and the spread of invasive pests and diseases form a big threat to trees. Climate change is also having a clearly measurable impact (Botanic Gardens Conservation International, 2021). As mentioned in the paragraph above, the position of trees on the island is weak. Only a small population of trees is present on the island and the several trees within that population are threatened with extinction. Changing vegetation is greatly affected by human impact (van Nooren, 2008). That trees are under threat of extinction is not surprising, considering de numerous threats to ecosystems and habitats on the island:

- Climate change
- Population growth (over-capacity)
- Unsustainable tourism
- High-impact recreation
- Unsustainable food sources/harvesting
- (fisheries & agriculture)
- Urban development
- Coastal development
- Private properties and lease
- land in protected areas
- Land clearing
- Invasive species
- Feral (domestic) animals (FPNA, 2023)
- Quarries (sand/stone mining)
- Landfills
- Pesticides, herbicides and insecticides
- Solid Waste pollution
- Water pollution by chemicals
- Sewage pollution
- Marine debris
- Soil degradation and pollution
- Air pollution
- Light pollution
- Noise pollution
- Trash pollution

The pressure ecosystems and habitats are under is enormous. But not all these threats are automatically major threats to trees. One major threat to trees and forests is overgrazing from free-roaming goats and donkeys (Park Work, 2020). The grazing causes a reduction of vegetation cover and a reduced regeneration of woody species (van Nooren, 2008). The terrestrial inventory of van Belle (2003) mentions threats per species. Overgrazing was observed as a threat to at least 3 tree species. Development is also a major threat, urban development usually requires land conversion

(Park Work, 2020). From the interviews, it is derived that goats are part of the culture on Aruba, which makes it hard to take away this threat to trees (Appendix III). In the terrestrial inventory of van Belle (2003) this threat is mentioned for 6 tree species. The TEEB report states Urban development puts terrestrial ecosystems under stress the most. This is in line with the statement that urbanization and economic growth affect the landscape of Aruba majorly (Derix, 2016). Development is a big threat to trees on Aruba while the current urban density is already 41,1% (Polaszek, Lacle, van Beukering, & Wolfs, 2018). Besides pollution is mentioned by van Belle (2003) as a threat to at least 3 tree species. In more recent years pollution occurs in several forms. A lot of plastic pollution occurs on Aruba for example (Scisciolo, 2015), but also hazardous situations regarding the water treatment plant threatens the Bubali nature reserve (Antiliaans Dagblad, 2023). Lack of regeneration is mentioned most, at least for 21 tree species. Lack of regeneration can all be caused by the threats already mentioned before. The last threat to native trees is invasive species. Alien species can compete with native species, and when they turn invasive they have the power to overrun native species entirely. Invasive species must be taken into account on the islands. In "Naturalised and invasive alien plant species in the Caribbean Netherlands" stated that it must be assumed that exotic species in this region have a stronger tendency to behave more aggressively, or in complement, the islands are more vulnerable to invasions (van der Burg, de Freitas, Debrot, & Lotz, 2012).

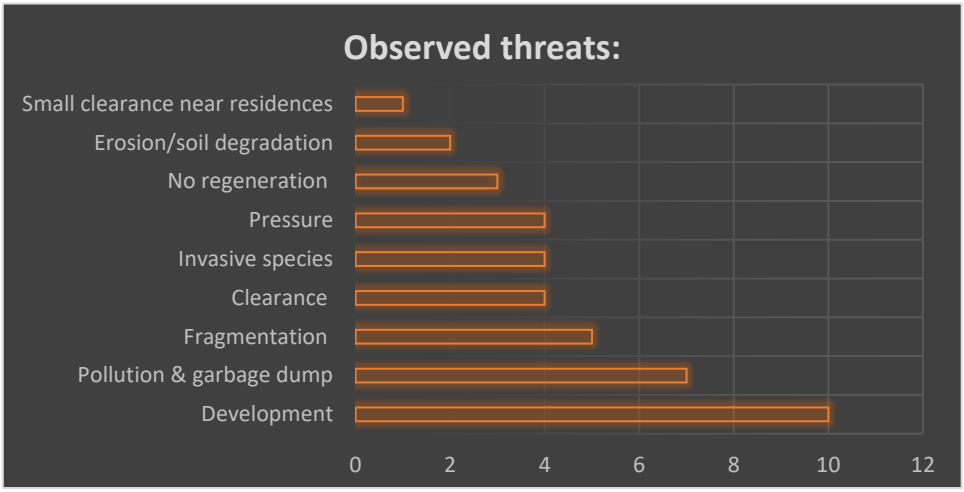
3.2.2.1 Threats per ROPV zone

During the field observation, visual threats to trees were listed as well. In Appendix II all observed threats, per zone they are observed in, are portrayed. A total of 14 threats were observed:

- Urban development
- Fragmentation
- Pollution
- Clearance
- Invasive species
- No regeneration
- Garbage dump
- Erosion/soil degradation
- Industrial development (clearance of shrubland)
- Small clearance near residences
- Pressure from tourism
- Pressure from high-rise hotel area
- Pressure from landfill
- Pressure from business park

Urban development is the most occurring threat, according to the observation. In 8 zones this threat is recorded. When adding industrial development to this, it can be said that 10 of the 15 zones are threatened by development. Garbage dumping is a form of pollution, when adding these two threats together, pollution occurs in 7 zones. Fragmentation, clearance and invasive species are also mentioned often as threats. At the bottom of the list of threats, it seems remarkable that "pressure" from different specific domains is mentioned. Pressure from human activity is the common threat here. The diagram in figure 3 portrays this.

Figure 3: Observed threats for observations



The top three observed threats are urban development, pollution and fragmentation. Development and pollution correspond with the threats mentioned in the paragraph above. Fragmentation in the observations, is named when trees are so fragmented through the landscape that regeneration is no longer possible. So the effect of fragmentation leads to the lack of regeneration.

In table 10 all threats per zone are portrayed. The nature reserve is the most threatened zone. This has to do with the fragmented pieces of nature zone on the west side of Aruba. No threats were recorded within Arikok National Park and the Spanish Lagoon. In general, threats are spread all over the island.

Table 10: Threats per zone

Threats	Nature reserve	Nature and landscape	Beach	Urban residential area	Residential area with value	Rural area	Centre of Oranjestad	Harbour of Oranjestad	Centre of San Nicolas	West coast tourist are	East coast tourist area	Airport	Business park Barcadera	Business park San Nicolas	Transformation area	Amount of zones the threat occur in:
Development				*	*	*	*	*	*	*			*	*	*	10
Fragmentation	*		*	*			*		*							5
Pollution & garbage dump	*	*		*		*	*						*	*		7
Clearance	*					*					*	*				4
Invasive species				*	*				*	*						4
No regeneration			*				*		*							3
Erosion/soil degradation	*	*														2
Small clearance near residences						*										1
Pressure	*	**	*													4
Amount of threats per zone:	5	4	3	4	2	4	4	1	4	2	1	1	2	2	1	

3.3 Governance

This chapter portrays how tree conservation on Aruba is incorporated into governance. What laws and regulations enhance the survival of trees and offer protection? It includes laws, treaties and policies that are in place to ensure protection. Besides two paragraphs are devoted to what governance looks like in practice.

3.3.1 Laws and Regulations

Aruba has a civil law system. Most laws and regulations are, to a large extent, based on the Dutch law system (Peeters, n.d.). To govern the country of Aruba properly, there is a separation of powers within the government. The states make the laws (legislature) together with the government. The government (the Governor and the ministers) implements those laws (executive power) and the court judges whether the legal rules are properly applied (Gobierno Arubaᵛᴵ, n.d.). Aruba has instituted several different nature laws. In the table below (table 11) laws and national decrees are summed up which affect trees. Besides, treaties and national decrees appointing nature reserves are left out. These are covered in paragraph 3.3.2. Treaties and 3.3.1.1. Nature Conservancy Ordinance.

Table 51: Aruban nature laws

Nature laws affecting trees		
1987	Landsbesluit Openbare Wateren en Stranden	AB 1987 No. 124
1995, February 13th	Natuurbeschermingsverordening Aruba	AB 1995 No. 2
1998	Hinderverordening	AB 1998 No. GT 27
2017, July 14th	Landsbesluit Bescherming Inheemse Flora en Fauna	AB 2017 No. 48
2019, July 17th	Landsbesluit ter vaststelling ruimtelijke ontwikkelingsplan	No. 1 DIP-3590
2021, July 30th	Landsbesluit ter vaststelling Ruimtelijk Ontwikkelingsplan met Voorschriften (ROPV)	AB 2021 No.123

In the context of tree conservation, the Nature Conservancy Ordinance is the most relevant nature law. In paragraph 3.1.1. the Nature Conservancy Ordinance law is there for further explanation. Besides the Spatial Development Plan with Regulations (Ruimtelijk Ontwikkelingsplan met Voorschriften, ROPV) offers protection to the status of different areas, and with that to trees. This is a legally binding policy, therefore mentioned here. The ROPV is explained in more detail in paragraph 3.3 Policies.

3.3.1.1 Nature Conservancy Ordinance

The Nature Conservancy Ordinance is the main nature protection law in Aruba. According to the Nature Conservancy Ordinance, it is illegal to partially or completely damage or remove a plant that is on the protected species list (article 6.2). The Nature Conservancy Ordinance makes it possible to establish a protected species list. The current protected species list was established in 2017 by the National Decree Protection Native Flora and Fauna (Landsbesluit Bescherming Inheemse Flora en Fauna, AB 2017 No.48). The list of protected species include species whose survival in Aruba is threatened (article 4.1) or whose presence in Aruba is so valuable that, although not threatened, protection is needed (article 4.2.a). On the protection list, 33 trees occur. The list below shows the trees on the endangered species list, with their scientific and local name:

- Avicennia germinans - Mangel Preto
- Bursera karsteniana - Palisia Blanco/Pal'i Siya Cora
- Bursera simaruba - Palisia Cora/Pal'i Siya Cora
- Bursera tomentosa - Palisia Dushi/Pal'i Siya Dushi
- Capparis flexuosa - Stoki / Mosterd
- Capparis indica / quadrella indica - Huliba macho
- Castela erecta - Turpin
- Celtis iguanaea - Beishi di Yuana/Rombèshi
- Clusia rosea -
- Condalia henriquezii - Beishi/sumpina
- Conocarpus erectus - Fofoti
- Crataeva tapia - Giron/zjiron
- Erythrina velutina - Palo di Bonchi
- Ficus brittonii - Mahawa
- Geoffroea spinosa - Taki
- Guaiacum sanctum - Wayaca macho
- Guapira fragrans - Bembe di porko
- Guapira pacurero - Macubari
- Haematoxylum brasiletto - Brazil
- Krugiodendron ferreum - Coushati/Caushati
- Laguncularia racemosa - Mangel
- Manihot carthaginensis - Yuca Amara/Yuca Guajira/Yuca di Mondi
- Maytenus sieberiana - Palo di Colebra
- Maytenus tetragona - Palo di Colebra
- Metopium brownei - Mansaliña macho/Mansaniya bobo
- Morisonia americana - Bushicuri
- Pereskia guamacho - Afuso/Supi
- Pithecellobium platylobum - Huñagato/Huña huña
- Pluchea carolinensis -
- Rhizophora mangle - Mangel/Mangel Tam
- Schoepfia schreberi - Mata Combles
- Spondias mombin - Hoba
- Trixis inula (Dowers, 2017) -

Aside from the protection of species, the Nature Conservancy Ordinance also offers the opportunity to appoint a protected status to areas by national decree (article 10.1). The national decree will appoint these areas as nature reserves. When appointing a nature reserve, rules can be imposed on these areas regarding management and accessibility (article 10.2). Within the nature reserves, all nature is protected, and therefore all tree species are protected. Nature reserves on Aruba are appointed to FPNA to manage. In table 12 the national decrees are listed that allocated nature reserves to FPNA.

Table 12: National decree appointing nature reserves

National decrees assigning nature reserves		
2000, August 24th	Landsbesluit Parke Nacional Arikok	AB 2000 No. 59
2004, May 19th	Landsbesluit Aanwijzing FPNA beheer Arikok	
2017, February 10th	Landsbesluit Aanwijzing Spaans Lagoengebied als natuurreservaat	AB 2017 No. 11
2018, December 20th	Landsbesluit Instelling ParkeMarino Aruba	AB 2018 No. 77

2019, January	Statuswijziging Stichting Fundacion Parke Nacional Aruba	
2019, April 16th	Landsbesluit Aanwijzing Beheer Parke Marino (Nr.1)	
2020, May 5th	Landsbesluit Nieuwe Aanwijzing Domeingronden als Natuurreservaat	AB 2020 No.67
2020, July 15th	Landsbesluit Aanwijzing FPNA Beheerder Natuurpark (Nr. 1)	

Punishments for violating the Nature Conservancy Ordinance differ between different articles. Relevant to trees, the following two maximum punishments can be imposed:

Two years jail, fine of 100.000 florin or both

- When exporting a tree from the protection list (article 5.1)
- When partially or completely damaging or removing a tree from the protection list (article 6.2)

Three months jail, fine of 10.000 florin or both

- When not obeying to rules set based on nature treaties (article 1.2)
- When not obeying to rules set concerning the nature reserves (article 10.2)

Besides article 4.2.b offers the opportunity to add individual plants or groups of plants to the protection list when their permanent presence in a certain place in Aruba is appreciated from the point of view of nature conservation. This article therefore allows appointing monumental trees for example. To enable this a national decree must be made and the community (as in article 2.1) must be heard (article 4.3).

3.3.1.2 Duty of care

Besides these nature laws, the government of Aruba also has a duty of care to ensure that trees do not damage or endanger Aruba's citizens and properties. Article 6:162 of the "Burgelijk Wetboek" of Aruba offers a legal framework to settle damage claims. This article could be used in a case where trees would cause damage, for example by falling branches or by falling over of the entire tree. Article 6:162 defines an unlawful act. Translated the unlawful act is described as "An infringement of a right and an act or omission in violation of a legal duty or with what is appropriate in society according to unwritten law, all this subject to the presence of a justification". In other words, article 6:162 can be consulted when harm or damage is caused as a result of an omission. Lack of maintenance and care for trees can be seen as omission. Regarding trees, the government should be aware of the risk a tree poses to causing damage (for example: inspecting trees on health) and carry out maintenance to prevent nuisance (for example: pruning weak branches in busy environments). It is advisable for the government to document maintenance and inspection work to help with regulating the activities which need to be taken to fulfil their duty of care and to have as proof of fulfilment of the duty of care.

Burgerlijk Wetboek van Aruba
Boek 6
Titel 3
Artikel 162.2
~
"Als onrechtmatige daad worden aangemerkt een inbreuk op een recht en een doen of nalaten in strijd met een wettelijke plicht of met hetgeen volgens ongeschreven recht in het maatschappelijk verkeer betaamt, een en ander behoudens de aanwezigheid van een rechtvaardigingsgrond."

3.3.2 Treaties

Aruba is part of the Kingdom of the Netherlands. The conclusion of treaties is considered an affair of the kingdom of the Netherlands. Because the Kingdom has the authority, they become part of the international agreements and therefore they are accountable under the international law. To Aruba, because of them being part of the kingdom, provisions of international agreements are binding. In case of incompatibility of those provisions with national law, the directly applicable international norm shall prevail (Leeuwe, 2017). The table below (table 13) shows all treaties Aruba has to abide by. The Nature Conservancy Ordinance offers a legal framework for the Aruban government to implement several treaties. As soon as a treaty provides protection to certain habitats, species or biodiversity in general, it can provide protection to trees. Treaties that can provide protection to trees are marked orange in table 13.

Table 13: Treaties Aruba has to abide by

Treaties		
1946, December 2nd	ICRW (whaling)	Effective: 1977, June 14th
1971, February 2nd	Ramsar convention (wetlands)	Effective: 1980, May 3rd
1972, November 16th	World Heritage Convention	Effective: 1993, March 22nd
1973, February 17th	MarPol convention (pollution from chips)	Effective: 1983, October 2nd
1975, July 1st	CITES convention (trade endangered species)	Effective: 1995, March 29th
1979, November 6th	CMS (migratory birds, habitats)	Effective: 1986, January 1st
1983, March 24th	Cartagena Convention (Marine environment WCR)	
1983, March 24th	The protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region	Effective: 1986, October 11th
1990, January 18th	SPAW protocol (coastal areas and wildlife)	Effective: 2000, June 18th
1999, October 6th	LBS protocol (waste regulation)	Effective: 2010, August 13th
1993, December 29th	CBD (biological diversity)	Effective: 1999, June 4th
1996, December 1st	IAC (sea turtles)	Effective: 2001, May 2nd
2003, October 17th	Convention for the Safeguarding of the Intangible Cultural Heritage	Effective: 2012, May 15th
2001, November 2nd	UNESCO Convention on the protection of the Underwater Cultural Heritage	Effective: 2009, January 2nd
2014, November 14th	SIDS SAMOA pathway (island nature)	
2015, September 25th	UN Sustainable Development Goals	
2015, December 12th	The Paris Agreement (climate)	Effective 2016, November 4th

Treaties that directly provide protection for tree species are Ramsar, CITES and SPAW. These three are there for explained in the following paragraphs.

3.3.2.1 Ramsar

The Ramsar treaty refers to the convention of wetlands which took place in Ramsar in 1971. This convention focuses on the protection of wetlands. The treaty obliges participating states to protect appointed lakes, rivers, underground aquifers, swamps, marshes, wet grasslands, peatlands, oases, estuaries, deltas, tidal flats, mangroves, other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans (Ramsar Convention Secretariat, 2016). The convention was organized because wetlands fulfil important functions in water management and as a habitat for special flora and fauna, especially birds. On Aruba, one Ramsar site occurs: the Spanish Lagoon. This is Ramsar site number 198 (Gobierno Arubaᵛ, n.d.). The Ramsar treaty does not protect specific species but areas. Spanish Lagoon is a nature reserve by national decree and therefore under the protection of the Nature Conservancy Ordinance and the Ramsar treaty. Management of the Spanish Lagoon is in the hand of FPNA.

3.3.2.2 CITES convention

CITES stands for Convention on International Trade of Endangered Species. This convention has the purpose of the conservancy of biodiversity worldwide. The convention protects flora and fauna species which are threatened with extinction. The treaty requires the establishment of a management authority and a scientific authority (Gobierno Aruba', n.d.). On Aruba both authorities, regarding Flora, are with the DLVV (see appendix 2, paragraph II, stakeholder DLVV). CITES classifies endangered species into 3 categories, based on how endangered they are. Every category comes with different protection status:

- Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
- Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.
- Appendix III includes species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. (CITES, n.d.)

Under CITES two tree species of Aruba are stated in Appendix II. Guaiacum officinale and Guaiacum Sanctum. Of these two, Guaiacum Sanctum is also on the endangered species list of the Nature Conservancy Ordinance and thereby obtains double protection.

3.3.2.3 SPAW

SPAW stand for Specially Protected Areas and Wildlife. SPAW is a regional agreement for the protection and sustainable use of marine biodiversity in the Wider Caribbean Region. SPAW projects areas with high ecological value as well as threatened species and their habitats. SPAW offers 3 annexes with species that are protected.

- Annex I list plant species subject to the highest levels of protection—endangered and threatened species, subspecies, or their populations as well as rare species.
- Annex II list animal species subject to the highest levels of protection—endangered and threatened species, subspecies, or their populations as well as rare species.
- Annex III lists both plant and animal species. Parties must adopt appropriate measures to ensure these species' protection and recovery. This annex is not intended to be more restrictive than the provisions of Annexes I and II; therefore, some regulated harvest may be permitted (Office of Protected Resources, 2021).

Annex I lists no species occurring on Aruba and Annex II is not relevant for this tree policy. In Annex III the following tree species are listed (SPAW, 1991):

- Avicennia germinans Mangel preto
- Conocarpus erecta Fofoti
- Guaiacum officinale Wayaca
- Laguncularia racemosa Mangel
- Rhizophora mangle Mangel tam

4 of these 5 tree species are also protected under the Nature Conservancy Ordinance. The 4 tree species, that are under the protection of the Nature Conservancy Ordinance and the SPAW treaty, are Avicennia germinans, Conocarpus erecta, Laguncularia racemose and Rhizophora mangle. The SPAW protected species, that is not protected by the Nature Conservancy Ordinance, is Guaiacum officinale. The Guaiacum officinale does accumulates protection under SPAW Annex III and CITES appendix II.

3.3.3 Policies

Above, all legal frameworks for nature management on Aruba are presented. But nature management is not simply following laws and regulations. To ensure the preservation and management of nature, plans must be in place which guide actions towards nature's flourishing. FPNA, the nature management organisation responsible for managing the nature reserves, has three management plans/policies in place, as shown in table 14.

Table 14: Policies of FPNA

Policies and plans from FPNA	
2017, November	Management plan Spanish Lagoon
2019, October 23rd	Preliminary Management Plan, Parke Marino Aruba
2023	Multi Annual Corporate Strategy 2023-2032

All these policies cover the nature reserves managed by FPNA. None of these policies is focused on trees specifically. However these areas are already legally protected, and therefore trees are protected. Also, the Multi Annual Corporate Strategy shows that preservation and conservation are a priority to FPNA (FPNA, 2023). This includes the conservation of trees.

Areas outside of the nature reserves are under the care of the government. Plans and policies regarding nature, from the past 5 years, are portrayed in table 15. The Aruban government publishes most policies and plans in Dutch, therefore an English translation is added.

Table 15: Policies of the Aruban government

Policies and plans from the government		English translation
2018	Natuur- en milieu beleidsnota 2018-2021	Nature and environment policy memorandum 2018 - 2021
2019	Ruimtelijk OntwikkelingsPlan (ROP)	Spatial Development Plan
2019, September	Policy Build With Nature	
2020, January	Aruba National Strategic Plan 2020-2022	
2021	Ruimtelijk OntwikkelingsPlan met Voorwaarden (ROPV)	Spatial Development Plan with Conditions
2022, December	CROW criteria voor plantsoenbeheer	Criteria for park management
	DOW Snoeivoorwaarden	Pruning conditions

3.3.3.1 Nature and environment policy memorandum 2018-2021

In 2018 the Ministry of Spatial Development, Infrastructure and Environment developed a nature and environment policy memorandum. In this memorandum, a SWOT-analyses has been done regarding four different environmental subjects. The subjects are waste management, habitats & species, environment & health and climate change. To encounter the weaknesses brought forward by the SWOT-analyses a total of 29 action points, divided among the four subjects, are formulated (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu', 2018). Three action points stand out when reading the memorandum from a tree conservation perspective.

- In the action plan for habitats and species, action 1 is “Legislation in the field of nature protection”. This action describes 4 activities of which the first two are the adjustment of the Nature Conservancy Ordinance and enact legislation regarding exotic species. The timeframe given for this action point was 2018-2020. During the interviews, it became apparent that this action has not been executed.
- In the action plan for habitats and species, action 3 is “Reforestation”. The description mentions reforestation and the planting of indigenous flora. As the main actor for this action, DNM is mentioned. During the interviews however it became apparent that DNM does not organise reforestation projects themselves, nor do they actively support or are involved with organisations that do. Reforestation currently happening on Aruba is totally independent of the government.
- The memorandum outlines a lack of enforcement. Lack of enforcement is described as a weakness in two of the four subjects. Multiple action points are regarding enforcement. During the interviews, multiple interviewees corroborate that enforcement, regarding nature and environmental issues, is still lacking.

3.3.3.2 Spatial Development Plan (with Conditions)

The spatial development plan (ROP) contains the spatial policy of Aruba. The ROP indicates what special development will look like in the following ten years. The ROP is established by means of a national decree. The ROP is the basis of the spatial development plan with regulations (ROPV). The ROPV is legally binding (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu'", 2019). The general vision of the Spatial Development Plan 2019 is a sustainable design of Aruba. This vision has been elaborated into the following principles:

- Creating a healthy and safe living, working and residential environment throughout Aruba
- The search for a balance between economic & social developments and nature & the environment.
- Applying sustainable use of space and maintaining and strengthening Aruba’s value, qualities and identity
- Designate concrete programs with measurable indicators based on the Sustainable Development Goals.
- To work well with all partners.
- Transition to a sustainable and circular economy (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021).

The ROPV uses land-use stratification to appoint functions to different areas. The ROPV comes with a map that indicates 17 different zones (see image 1, paragraph 2.3.2). Every zone has its own description, functions and rules. The ROPV is published in Dutch and below are the 17 zones, with translation:

- Natuurgebied — Nature reserve
- Natuur en landschap — Nature and landscape
- Strand — Beach
- Stedelijk woongebied — Urban residential area
- Woongebied met waarden — Residential area with value
- Landelijk gebied — Rural area
- Centrum Oranjestad — Centre of Oranjestad
- Havenfront Oranjestad — Harbour of Oranjestad
- Centrum San Nicolas — Centre of San Nicolas
- Toeristisch gebied westkust — West coast tourist area
- Toeristisch gebied oostkust — East coast tourist area
- Luchthaven — Airport
- Bedrijventerrein Barcadera — Business park Barcadera
- Bedrijventerrein San Nicolas — Business park San Nicolas
- Transformatie gebied — Transformation area
- Marinegebied — Marine area
- Marinezones — Marine zones

Table 16: Areas with function natural values

The conservation, restoration and development of existing natural values
Nature reserve
Nature and landscape
Beach
West coast tourist area
Marine area
Marine zones

All zones have their own functions and matching conditions. A few function descriptions indicate possible livelihood for trees. One function that is mentioned in most areas is “the conservation, restoration and development of existing … values”. Values that could include trees are natural, ecological, scenic and cultural-historical values. A total of 6 zones have the function of conservation, restoration and development of natural values. Table 16 shows in which areas these natural values value mentioned. In this list, it stands out that the west coast tourist area also has this function listed. This is striking because the west coast tourist area is fully developed (see paragraph 3.2.1.3).

Table 17: Areas with function ecological values

The conservation, restoration and development of existing ecological values
Nature reserve
Nature and landscape
Beach
Urban residential area
Residential area with value
Rural area
East coast tourist area
Marine area
Marine zones

9 zones have the function of conservation, restoration and development of ecological values. Table 17 shows in which zones ecological values are conserved, restored and developed. In this list, east coast tourist area occurs. This is also striking considering this area is being developed right now, and lots of construction is occurring here (see paragraph 3.2.1.3).

Table 18: : Areas with function scenic values

The conservation, restoration and development of existing scenic values
Nature reserve
Nature and landscape
Beach
Urban residential area
Residential area with value
Rural area
West coast tourist area
East coast tourist area

8 zones have the function of conservation, restoration and development of scenic values. The zones that mention scenic values in their function are shown in table 18. Scenic values do not automatically protect trees but it does protect the scenic view of the area. In the nature reserve, nature and landscape, beach, residential area, residential area with value and rural area these scenic views include trees.

Table 19: Areas with function cultural-historical values

The conservation, restoration and development of existing cultural-historical values
Nature reserve
Nature and landscape
Beach
Urban residential area
Residential area with value
Rural area
Centre of Oranjestad
Harbour of Oranjestad
Centre of San Nicolas
East coast tourist area
Transformation area

11 zones include the function of conservation, restoration and development of cultural-historical values. In table 19 all zones are listed which have this function. Big old trees, or trees with cultural value could gain some protection through this function *(Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021)*.

Table 20: Areas with function greening or park

Greening or park function
Urban residential area
Residential area with value
Rural area
Centre of Oranjestad
Harbour of Oranjestad
Centre of San Nicolas
West coast tourist area
East coast tourist area
Airport
Business park Barcadera
Business park San Nicolas
Transformation area

One other function also creates space for trees in the urban setting of Aruba. This is the function of greening or park. In table 20 the zones are listed which have the function of greening or park listed in the ROPV. 12 zones have this function listed, all are urban areas. The function mentioned here could incorporate nature and possibly trees. However, this is not specified in the policy. Besides, all areas have multiple functions. And some of those functions are hard to combine with the conservation of trees, like overnight recreation in hotels, day recreation, companies, port-related companies, offices and services *(Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021)*. The functions by themselves are not perse destructive to trees, but the space needed for these functions often goes at the expense of space for nature.

Besides, the ROPV also includes mentions the Ecological Main Structure. The document entails an Ecological Main Structure man (image 3). The spatial development plan states that it is not allowed to build within the Ecological Main Structure. It also stated that the Ecological Main Structure is allowed to be expanded if research has shown that areas or zones not indicated on the map, contain significant natural, ecological, landscape, hydraulic, cultural-historical or geological values and it is desirable for them to be part of the main structure (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021). Unfortunately, the Ecological Main Structure is not further elaborated.

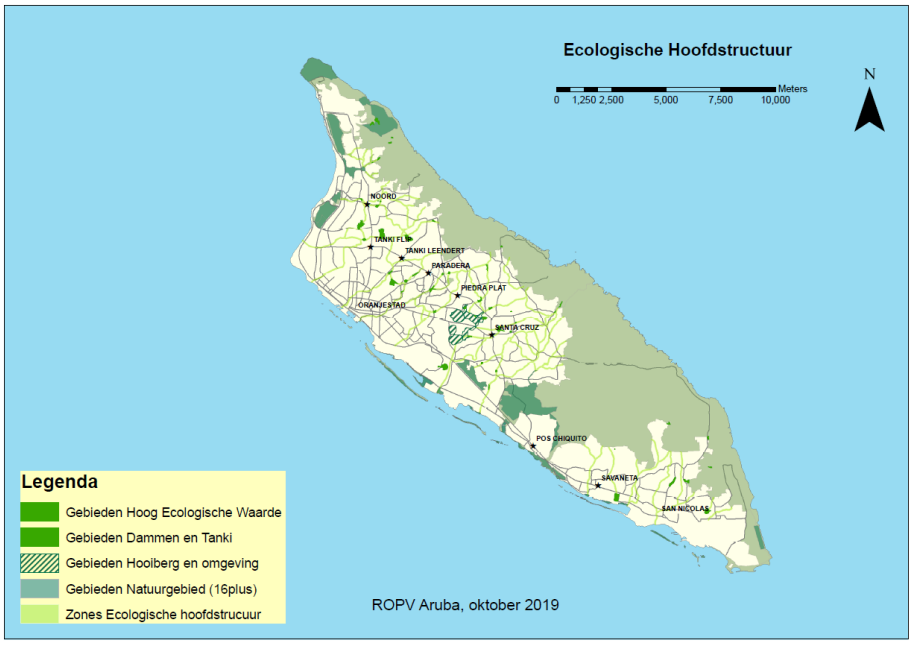


Image 3: Ecological Main Structure (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021)

The ROPV also includes a “DNM Nature area map” (see image 4). This map is not elaborated on in the document. It however shows several areas that are not included in the nature reserves or the Ecological Main Structure.

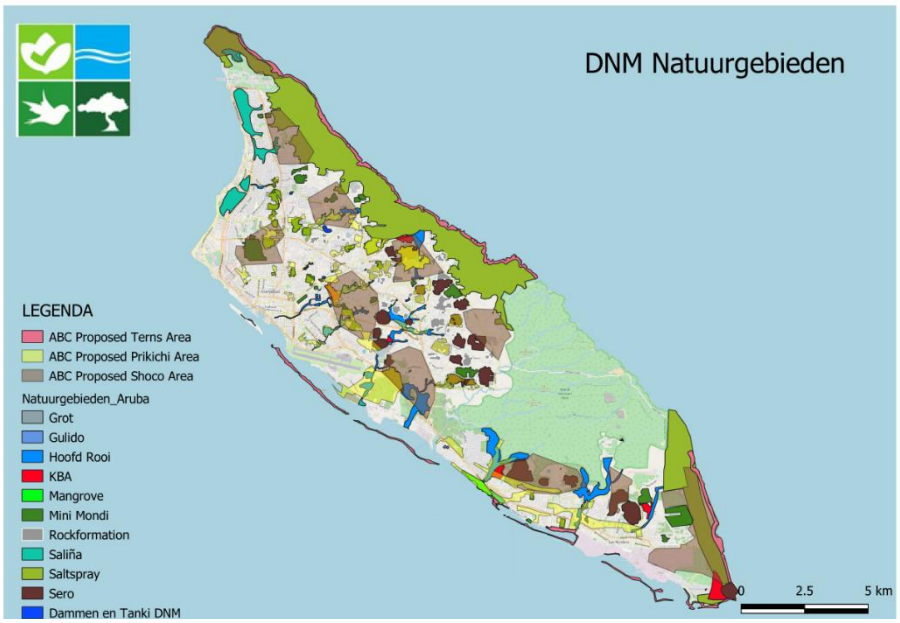


Image 4: DNM Nature Areas (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu", 2021)

During the field observations, in the following five zones the most trees species were observed:

- Nature reserve
- Residential area with value
- Urban residential area
- Rural area
- Business park Barcadera

Table 21: ROPV zones and functions

ROPV Zone	Amount of protective functions
Nature reserve	4
Residential area with value	3
Urban residential area	3
Rural area	3
Business park Barcadera	1

Nature reserve has 4 out of the 5 functions that can provide some protection (table 21). Besides, these zones are included in the Ecological Main Structure. Residential area with value, Urban residential area and Rural area has 3 functions in the ROPV that can provide some protection. And Business park Barcadera only has one function mentioned in the ROPV that could provide some protection to trees. The Ecological Main Structure provides protection to small, fragmented areas scattered through these zones. Remarkably, the residential area with value, rural area and business park Barcadera all overlap with either "ABC: Proposed Choco Area" or "ABC: Proposed Prikichi Area" on the DNM nature area map. This shows ecological value but no protection.

3.3.3.3 Build With Nature

The Build With Nature policy is a policy that tries to incorporate nature preservation into urban development. Within the spatial development plan, it is mandated that the Build With Nature policy has to be taken into account when developing new properties. With implementing the Build With Nature policy, the Aruban government admit that environmental effects have not been taken into account enough during development projects in the past (Directie Natuur en Milieu, 2019). The following three goals are formulated in the Build With Nature policy:

- Protection of flora and fauna, by means of preservation of habitats, connectivity between habitats and ecosystem services.
- Sustainable development of Ecological Main Structure.
- Creating a systematic approach in which natural values in government and private projects, road construction, housing construction, and hydraulic engineering projects are characterized and developed holistically and sustainably with this knowledge.

Unfortunately, the Ecological Main Structure is not further elaborated in this document. The two most concrete ideas elaborated in the Build With Nature policy are the concept for urbanization and the procedure for allotment plans of separate plots bigger than 750 m^2. The concept for urbanization described how there should be gradually more space for nature, within urban areas, moving away from the city centre. This should create bigger connectivity between natural areas and should ensure the preservation of nature, even within urban areas. This concept is translated into the spatial development plan. The procedure for allotment plans of separate plots bigger than 750 m^2, establishes a mandatory assessment of plots bigger than 750 m^2. The procedure ensures that all plots bigger than 750 m^2 are being inspected by the DNM before development. From these inspections, advice is derived. This should ensure the protection of vulnerable species on the lots if these occur there (Directie Natuur en Milieu, 2019). Unfortunately, from the interviews, it became apparent that it is no longer the standard practice to issue plots that big. Therefore a lot of plots, where possibly endangered species occur, are not being inspected before development.

3.3.4 Social Political Landscape

The function of this paragraph is to paint a picture of the social political landscape of Aruba. In the paragraphs above, laws and regulations are already elaborated. This paragraph focuses on what the landscape looks like towards nature conservation, in practice, based on the interviews.

Statements made in multiple interviews are portrayed in table 22. The statements are divided into statements that describe a situation with positive effects on tree conservation and statement with negative effects on tree conservation.

Table 22: Positive and negative interview statement about the social political landscape

Situation with positive effect		Situation with negative effect	
Statement	**Amount of interviews**	**Statement**	**Amount of interviews**
There is growing attention for nature conservation. Within society there is a growing demand for nature solutions, but not always from a nature conservation perspective. More awareness with the younger generation. Politically the awareness is growing.	4	But the growing awareness is still in the beginning stage and needs to grow more to make a difference.	4
The new minister of nature. In previous parliaments, this position did not exist. The appointment of this minister is seen as a development towards better nature conservation.	3	There is no interest or priority for nature (conservation) in the current political landscape.	2
		Expertise is missing. Not everybody is aware of their tasks. But also the knowledge within organisations on how to deal with environmental issues seems to be missing. It is mentioned that education on a professional level is necessary.	3
		Culturally speaking trees can be seen as a burden on Aruba. People prefer their property to be “clean” and tidy. So no leaves in the yard. Besides, if a tree loses flowers or its leaves (non-evergreen trees), they lose their function.	3
		There is a big focus on expanding the economy. With this statement often is mentioned that the priority lies more with economic growth than nature conservation. These two subjects are in disbalance.	4

Positive developments within the social political landscape:

For the first time, the government has appointed a minister of nature. Three out of the seven interviewees see this as a positive development of the government towards better nature conservation. Four out of seven interviewees mention that there is a growing awareness for nature conservation, within society as well as in politics. These positive developments are an opportunity and can be used in the recommendations.

Negative developments within the social political landscape:

As mentioned above, the awareness of nature conservation is growing on Aruba, however, it is also mentioned that this is not enough yet. There is a disconnect between people and nature. From the interviews, it became apparent that the political field is constantly changing on Aruba. Currently, the conservative party forms the government. The expansion of the economy is a priority for the government. The current model for that is to expand the tourism sector. Unfortunately, this often is at the expense of nature. This might be because the government doesn't give priority to nature conservation (two out of seven interviews) or it can be the lack of expertise within the government (three out of seven interviews). Culturally there is an existing view that sees nature, and the debris it can leave on properties, as "dirty". This can make people see trees as a burden. Because of this, plots are often cleared of all vegetation as soon as they are released. Another social construct that doesn't favour nature conservation is the economic struggle of the community. Two interviews mention the financial burden most households are under. The fact that people worry about the high cost of living, limits the capacity to worry about anything else, like nature conservation.

3.3.5 Enforcement

Police are responsible for law enforcement on Aruba and with that nature laws like the Nature Conservancy Ordinance. Besides police officers, there are also civil servants who are trained to be investigating. A civil servant like this is referred to as a "BOA". These officers are appointed civil servants who have the authority to issue official reports, which are legally binding, also known as a "process verbal" (De Rechtspraak, n.d.).

Enforcement of nature laws does not seem to happen at all. Five out of seven interviews confirm this view and the other two do not contradict this (they did not comment on the subject due to lack of knowledge). Multiple people gave examples of nature destruction happening without any consequences for those who caused the damage. Reporting crimes against nature to law enforcement, within and outside of the national park, does not result in action (mentioned in three interviews). Police have clarified to those interviewees that this is due to a lack of capacity. While it is necessary for a crime to be caught in the act for law enforcement to be able to enforce it (mentioned in two interviews). Media coverage collaborates with the statements of the interviews. Opinion articles and news articles from the past 3 years mention lack of enforcement, lack of inspection and citizens filing complaints that are not being followed up (Balentina, 2022) (Balentine, 2022) (Henriquez'', 2022) (Henriquez', 2021). In the articles, it is mentioned that the DOW does not abide by agreements made and DIP does not perform their supervisory duties.

Within the nature reserves, also no enforcement is happing. Law enforcement is not responding when crimes within the park are reported, and FPNA does not have the authority to enforce themselves. Preferably FPNA has their own BOAs, however, this has not happened yet due to a technicality within the Aruban law (mentioned in two interviews). According to the law, only civil servants are allowed to become BOAs. Because FPNA is a non-governmental organisation, their personnel cannot be trained and appointed to become BOAs. The only opportunity for enforcement within the park would be governmental BOAs being assigned to work for FPNA, or changing the law so not just civil servants, but also appointed people can become BOAs.

An important factor, that makes enforcement hard, is the island culture. Due to the community being small, a lot of people know each other. Enforcing rules upon friends, family members or neighbours can cause conflict and conflict can have major effects on daily life (mentioned in two interviews). This can complicate enforcement and can prevent social enforcement from happening entirely. This is a complex social structure that needs to be taken into account when making a policy.

3.4 Stakeholders

Nature management crosses many domains, like:

- Tourism and recreation
- Urban and Spatial Planning
- Agriculture, Livestock and Fisheries
- Disaster Response
- Enforcement
- Climate Change
- Waste Management
- Education (primary, secondary, tertiary)
- Research (academic)
- Sustainability (SDGs)
- Water Management
- Energy
- Environmental degradation
- Economy
- Cultural Heritage
- Sport and Wellbeing
- Maritime

Activities in all of these domains can affect nature conservation and tree survival if they do not take nature into account (FPNA, 2023). However, elaborating on all stakeholders from all domains would divert the attention from the most relevant stakeholders. From the literature research, 7 stakeholders were identified as directly involved with tree conservation. These stakeholders are involved with land management, and therefore with the management of trees on Aruba. Of those stakeholders, 4 are a department of the government of Aruba, the others are non-governmental organisations (NGO's). what these seven stakeholders do, and how they are involved with tree management, is explained in the paragraphs below.

3.4.1 Governmental Stakeholders

The government is responsible for the care of Aruba. For the tree policy, four department of the government were identified as most involved with tree conservation. Two of them because of their position in land use and two of them because of their connection to nature conservation.

3.4.1.1 DNM

DNM stand for Directie Natuur en Milieu, which translates to Department Nature and Environment. DNM is a department of the Aruban government, working for the Ministry of Transport, Integration, Nature and Elderly Causes (Ministerie van Transport, Integratie, Natuur en Oudere zaken, TINO). DNM has been established on January 1st 2012. The DNM has the following purpose formulated:

> *The purpose of the Directorate of Nature and the Environment is to prepare, design, implement and evaluate government policy that leads to a sustainable and healthy living environment for human and nature in Aruba, focusing on the preservation, protection and improvement of natural and environmental qualities* (Gobierno Aruba", n.d.).

The department is divided into 6 divisions: general support, legal support, communication support, policy, research & monitoring and inspection. The core tasks of DNM are policy-making, research & monitoring and inspection (Directie Natuur en Milieu, n.d.).

In the interviews, it became apparent that DNM is trying hard to incorporate nature more within governmental policies. They are committed to advocating for nature within governmental departments. Other departments can approach DNM for advice. Unfortunately, it isn't obligatory to follow up on the advice. Right now they keep busy with writing rights of nature within the Aruban constitution. Concerning policy writing, DNM has the authority on policy writing for the Aruban Government and believes in writing policy from a bigger frame. So if you would like to set up an area especially for the Choco (burrowing owl), Dori (frog) or Prikichi (parakeet) it should contain elements a Choco needs. After a plan for a goal like this is made, only then certain tree species can be chosen to fit that goal, and a tree policy on this can be implemented.

3.4.1.2 DIP

DIP stands for Directie Infrastructuur en Planning, which translates to Department for Infrastructure Management and Planning. DIP is a relatively young government agency that was established in 2003. They fall under ministry of general affairs, innovation, government organisation, infrastructure and spatial planning (Ministerie van algemene zaken, innovatie, overheidsorganisatie, infrastructuur en ruimtelijke ordening). Their mission is to meet the demand for land/soil/space through integrated and planned spatial development. In order to guarantee a sustainable and liveable environment for current and future generations (DIP, n.d.).

DIP determines policy. They work conform the national ordinance spatial development and national ordinance issuance properties (De landsverordening uitgifte eigendommen). DIP is responsible for spatial development and land allocation. Even though getting a building permit goes through the DOW (see paragraph 4.1.3. DOW), the DIP determines land use. DIP formulated goals for themselves, those affecting land areas with trees, are:

- The development and implementation of spatial plans, that facilitate an integral and systematic development of Aruba.
- Adequately assisting citizens, who as yet have no plot of land however, have petitioned for a plot, to achieve their housing-construction goal in a manner that is transparent and easy to understand.
- Efficiently create new plots for housing construction to suit the customers' demand and ensures a balanced 'occupation' of Aruba. To serve the housing possibilities on a short term leading to a planned high quality living environment.
- Ensure the optimal use of the existing infrastructure in the already developed areas. With the aim to contribute to solving the housing issue and improving the quality of life.
- To execute an adequate and efficient administrative management of the already issued plots of land and waters.
- Through the up-keep of or enforcing of regulatory compliance guarantee the legal assurance and protection of citizens, institutions and companies. Therefore guaranteeing the quality of the environment.
- To effectively contribute to the economic, social and corporate social development of Aruba by zones.
- To create and complete them with economic, corporate social and social functions (DIP, n.d.).

Nature management, biodiversity or trees are not mentioned in any of the goals, vision or mission of the DIP. They do however speak about quality of life, quality of living environment and social developments. These terms can indirectly be linked to nature within these environments.

In the interviews, the following is mentioned. DIP is trying to take nature more into account. In allotment plans, DIP tries to spare areas with the most dense vegetation. They also try to issue

smaller building lots than they did in the past. Firstly to be more efficient with space. They want to enable everybody to have property regardless of the overcrowding of Aruba. Secondly to protect nature and leave more space for green. They try to make smaller plots with more space in between. So the space between houses can stay green. Issuing smaller plots is a big change for Aruba, and causes tension and struggle. With the community but also internally. In the interviews, it is mentioned that, in this struggle, DIP can benefit from more expertise.

DIP has the responsibility to verify and check if land owners use their land for their intended goal (Gobierno Aruba, 2020), however, in the interviews, it is mentioned that they do not employ BOAs and therefore have no authority for law enforcement.

3.4.1.3 DOW

DOW stands for Dienst Openbare Werken, which translates to Department of Public Works. DOW is a department of the Aruban government. The DOW has the task of ensuring and contributing to a well-ordered and high-quality physical living environment in Aruba, according to policies and in a systematic manner, as well as with the required (legal) instruments, for the benefit of the Aruban Community, its guests and its strategic partners. Besides the executive role, DOW has a policy advisory role towards the government and government departments as well. The DOW supports the government in the decision-making process concerning policies and in providing transporting- and working capacity. The DOW acts as an emergency service, sounding board or discussion partner in all kinds of public projects, even when they are not necessarily directly involved in the implementation. They are charged with the implementation, compliance and supervision of construction and housing ordinances, decrees and permits. DOW's legal obligations are stated in the "Landsbesluit Openbare Aanbestedingen (AB 1996 no. 58)" and the "Uniforme Administratieve Voorwaarden" from 1989.

In other words, the DOW is responsible for the design, maintenance and management of the public domain, to give substance to the governmental departments that are responsible for public space. They translate policies into strategic development and tangible projects, within the financial and social policy framework set by the national government (DOW, n.d.). DOW's field of work lies in civil engineering. They handle building permits and everything under the build ordinance (bouwverordening).

Regarding nature management and trees DOW is responsible for park management (plantsoen beheer). This means public gardens and city parks, not the nature reserves, these are under the management of FPNA. This park management also includes trees and shrubs along roadsides. During the interview they confirmed that they have a duty for tree care, to make sure they do not harm citizens or cause damage. For park management, they work with a GIS platform and CROW policy. CROW contains criteria for all types of nature within the city (think of trees, bushes, weeds), and what they should look like. Every green zone gets rated and the rate determines if they are good as is, if they need maintenance or if they need major maintenance. Different areas have different quality requirements. The DOW hires private contractors to execute the park management activities, and they also work with the same criteria. Working with the CROW policy is new since it only has been implemented in December 2022. On a GIS platform, the DOW formulates which parks have been inspected by the CROW criteria, which need maintenance or other actions. This GIS platform entails all parks and roadsides DOW is responsible for, not individual trees.

When DOW builds new parks and green zones they call in their own department design and planning to come up with a plan for the new park. They use the rule to preferably plant out native tree species as a guideline, however in practise this doesn't always work. Seedlings used in these parks come from either the greenhouse of Santa Rosa/DLVV or Fantastic Garden (store).

3.4.1.4 Santa Rosa/DLVV

Santa Rosa is the Department of Agriculture, Livestock, Fisheries and Farmers market, but is also often referred to as the Directie Landbouw, Veeteelt en Visserij or DLVV. Santa Rosa is a department of the Aruban government, working for the Ministry of Tourism, Transportation and Labour. The department was established in 1976 as an experimental station (Santa Rosa, n.d.). Later their goal was formulated as making more efficient use of the financial and natural resources by promotion and development of agriculture, with particular attention to horticulture, livestock and fisheries. Besides this, they were responsible for ensuring the conservation and management of the natural environment. This task has now shifted to the DNM. Now Santa Rosa is focused on growing and researching different types of crops and fruits and initiatives on exploiting locally grown food sources (Gobierno Aruba"', n.d.).

Santa Rosa's involvement with nature management has varied over the years. The interviewee describe that at the end nineties the idea, within Santa Rosa, was to do less agriculture and more nature management. This shift was due to easy and cheaper access to food through trade. Changes in departments and the establishment of DNM took most of nature management away from Santa Rosa. Because of trade restrictions from Venezuela and the covid pandemic, Aruba felt vulnerable due to less trade, therefor the idea to maybe start growing more food on the island came back.

Santa Rosa's connection to nature management is still existing through CITES. They are the department within the Aruban government that is responsible for complying with the CITES convention regarding flora and insects. They are the scientific and enforcing authority of CITES flora. When handling the trade of tree species from the CITES appendix 2, Santa Rosa handles paperwork for permission in trade. Intercepting illegal trade of these species is the responsibility of customs.

3.4.2 Non-governmental Stakeholders

Non-governmental organisations, or NGO's, are groups that function independently from the government (Folger, 2023). On Aruba, several NGO's keep busy with nature conservation. Three that have been identified as most relevant to tree conservation can be found in this paragraph.

3.4.2.1 FPNA

FPNA is an NGO that identifies as an independent professional nature conservation organisation. FPNA stands for Fundacion Parke Nacional Aruba. They are responsible for the conservation and management of several designated terrestrial and marine nature reserves. FPNA is committed to the preservation, protection and restoration of all of Aruba's heritage. In their own words, FPNA is first and foremost a nature conservation management organization which focuses on the execution of species and habitat conservation programs for biodiversity enhancement, ecosystem restoration, and protected area management, while educating and raising public awareness, and making the protected areas sustainably accessible to visitors for their enjoyment (FPNA, 2023). FPNA works according to the principles of ecosystem-based management. FPNA works from their vision:

Through conservation leadership excellence, we lay the foundation for thriving biodiversity, resilient ecosystems, and celebrated heritage, for a sustainable Aruba.

On August 24th 2000 Arikok National Park was established. On September 26th 2003 FPNA was founded and on May 19th 2004 the Aruban Government officially appointed park management to the

organisation. Back then FPNA managed only Arikok National Park, which entailed 34 square meters, approximately 20% of the terrestrial area on the island. Back then the organisation was called Fundacion Parke Nacional Arikok, but in 2017 they changed Arikok to Aruba. Because since 2017 several nature reserves were added to their care. With the addition of these nature reserves, FPNA now manages 24,3% of Aruba's terrestrial area. This expanded the responsibility and complexity of FPNA's task and therefore the organisation changed their governance structure. In 2019 FPNA replaced their one-tier structure with a two-tier structure so that they now operate under an executive board, as well as a supervisory board (FPNA, 2023).

The interview clarified that FPNA feels they have the obligation to protect nature. It is the core purpose of their existence. The way people are incorporated into nature preservation is key. One of the most relevant aspects of nature conservation is the way people are approached with it because it is a team afford to protect the world. Within FPNA there is a big disappointment about the fact that rangers are not allowed to enforce the laws within the park. They witness the destruction of nature on a daily bases but are unable to act.

3.4.2.2 Ban Lanta y Planta

Ban Lanta y Planta, also known as Trees of Aruba, is a foundation focussed on reforestation on Aruba. The organisation is relatively new and was founded during the COVID-pandemic, only in 2020. Their focus is on all native and naturalised trees of Aruba. For reforestation, they use the guideline principles of regenerative Forest Landscape Restoration (FLR). FLR strives for restoring a whole landscape and regaining its ecological functionalities across deforestation or degraded forest landscapes. FLR is a means of regaining, improving and maintaining vital ecological and social functions, in the long term leading to more resilient and sustainable landscapes. It aims to enhance species and genetic diversity (Trees of Aruba, n.d.).

In the interview, it became apparent what this looks like in practice. Ban Lanta y Planta is mainly focused on reforesting an area of 120 hectares in Noord. The area is owned by a foundation and is destined to become a self-sustaining forest. Pan Lanta y Planta has its own greenhouse where they grow tree seedlings, which they later use for planting out. The organisation consist of a group of motivated volunteers.

3.4.2.3 StimAruba

StimAruba is an organisation devoted to nature conservation and nature protection. They strive to preserve the Aruban nature by educating and guiding the inhabitants of Aruba (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu', 2018). They often involve themselves in public debate when nature is under pressure. They organise demonstrations and speak out critically about projects that may affect nature negatively (Henriquez'", 2022). They are active since 1992. In the interview, they stated that StimAruba is an association, that everybody can become a member of. Unfortunately, the membership base is declining and therefore StimAruba is considering converting into a foundation instead. StimAruba is active in education, giving courses, training guides and gave excursions. They focused on nature but also culture. They have produced folders and magazines about nature and areas on Aruba. They have good contact with other nature organizations and often are contacted to consult on projects.

3.4.3 Power Interest Stakeholder Analyses

All stakeholders indicate that they are interested in tree conservation and in a tree policy. Therefore all got rated as “interested”. Still, a distinction is made in how interested organisations seem to be. Below is listed based on what information the distinction is made:

- FPNA: Feels they have the obligation to protect nature, it is the core purpose of their existence.
- StimAruba: An organisation devoted to nature conservation and nature protection. They strive to preserve the Aruban nature.
- Ban Lanta y Planta: Foundation focussed on reforestation on Aruba. Their focus is on all native and naturalised trees of Aruba
- DNM: Committed to advocating for nature within governmental departments. They believe in writing policy from another perspective.
- DIP: Has goals about ensuring quality of life, the quality of the living environment and social developments. DIP is trying to take nature more into account.
- DOW: Is responsible for park management (plantsoen beheer).
- Santa Rosa: Scientific authority on CITES flora.

Regarding tree conservation the power and influence each organisation has, differs very much. The distinction made between influence and power is based on the information, is listed below:

- DIP: Is responsible for spatial development and land allocation. They work conform the national ordinance spatial development and national ordinance issuance properties. DIP has the responsibility to verify and check if landowners use their land for its intended goal.
- DOW: Is responsible for the design, maintenance and management of the public domain, to give substance to the governmental departments who are responsible for public space.
- FPNA: Is responsible for the management of 24,3% of Aruba’s terrestrial area.
- DNM: DNM has the authority on policy writing for the Aruban Government. Often entities are not obligated to follow up the advice. DNM also has the authority to inspect lots bigger than 750 m^2.
- StimAruba: Often involve themselves in public debate when nature is under pressure. They organise demonstrations and speak out critically about projects that may affect nature negatively. They have good contact with other nature organizations and the government and often are contacted to consult on projects. Unfortunately, the membership base is declining
- Santa Rosa: Their connection to nature management is still existing through CITES.
- Ban Lanta y Planta: Is mainly focused on reforesting an area of 120 hectares in Noord.

The government had the authority. They manage 75,7% of the terrestrial area.

DIP is the authority on spatial development. DOW is responsible for the public domain.

FPNA manages 24,3 % of the errestrial area

DNM advises on a lot of projects but their advice is not binding. Besides, power they have on the allotment, through “Build With Nature” policy, does not cover all activities.

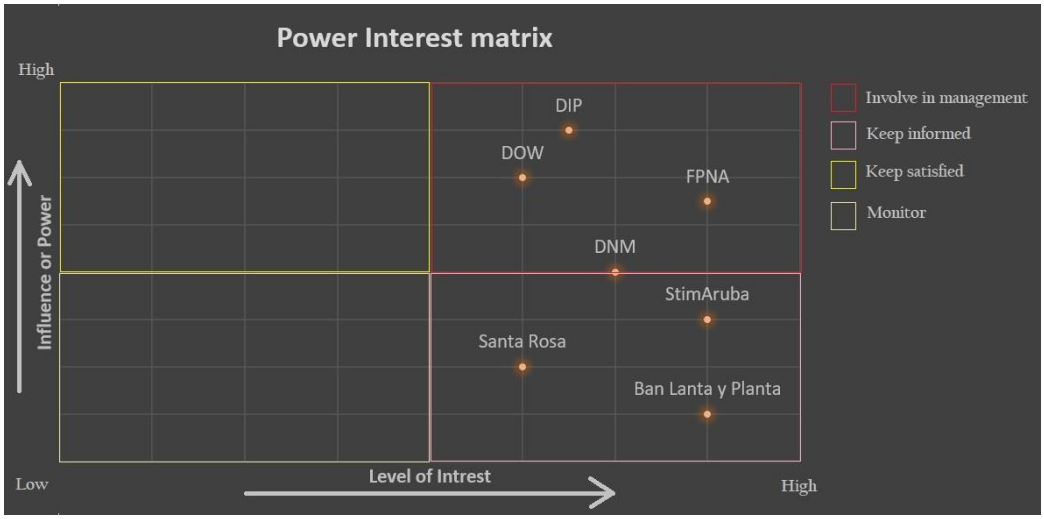
StimAruba is often approached for advice due to their respectable reputation. They are taken seriously. However, they are shrinking in size and activity

Santa Rosa had authority but is not at all involved in decision-making regarding land tenure.

Ban Lanta y Planta is affecting foundation properties but is not very involved besides that.

The information above is put into the power/interest grid. Figure 4 shows the power interest matrix filled in with the stakeholders.

Figure 4: Power Interest Matrix



Based on the power interest analyses, all stakeholders end up in one of two categories: Involve in management or keep informed. The several stakeholders belong to the following categories:

Involve in management

- DIP
- DOW
- FPNA
- DNM

Keep informed

- StimAruba
- Santa Rosa
- Ban Lanta y Planta
- (DNM)

DNM end up right on the edge between “involve in management” and “keep informed”. When involving them in management take into account that they might not have the amount of power or influence that is necessary. When only keeping them informed, take into account that you might be missing out on the influence they do have.

4. Policy criteria

Criteria will be developed to connect with the needs of trees on Aruba. The criteria will ensure that the recommendations have the desired outcomes. In this chapter, the criteria are derived. Based on the information from the island description and suggestions from interviewees.

4.1. Problem Tree

By addressing the causes, the protection of trees can be established. And by establishing protection of the tree population, the negative effects can be reduced or even prevented. To provide insight, into all information given in the previous chapters, a problem tree is developed. The problem, the declining tree population, is portrayed in the middle. Underneath, in the cause box, all factors are listed that negatively affect the tree population. Above, in the effect box, the negative effects of a declining tree population are portrayed. The lines in the problem tree show how intricately the causes, problem and effects are interconnected with each other. Image 5 shows the problem trees.

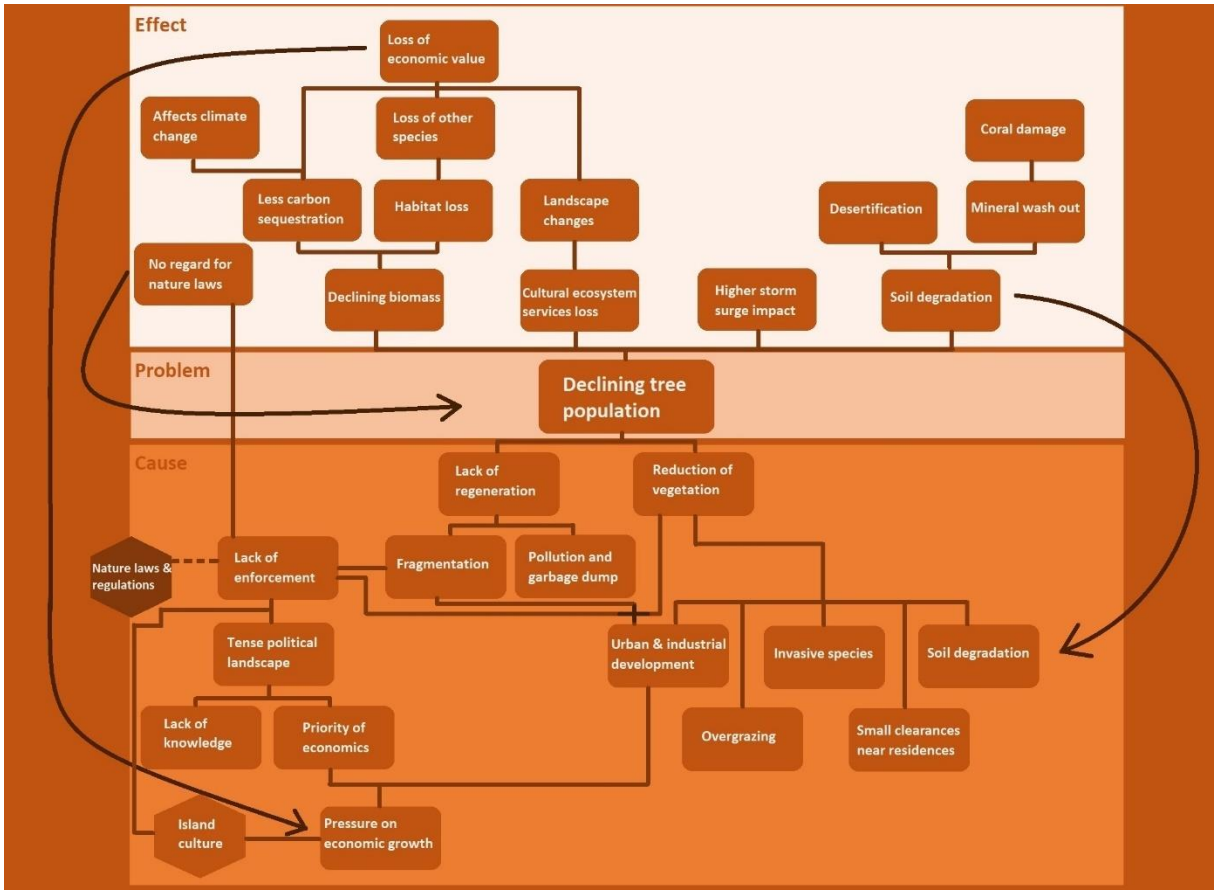


Image 5: Problem tree

The problem tree helps with the development of the criteria, by specifying the actions that need to be taken.

4.2. Policy Suggestions

Stakeholders are experts on the current situation on Aruba. Therefore their suggestions should be taken into account in the development of this tree policy. During the interviews, all interviewees were asked if they thought a tree policy was necessary or useful for Aruba. They all unanimously stated that a tree policy is necessary on Aruba. In table 23 the suggestions, the interviewees made about the tree policy, are listed. As well as the number of interviewees the suggestions are mentioned in.

Table 23: Policy suggestions

Suggestion	Covert objective	Mentioned in
Improvement of enforcement	*	3
Creating more trees, more space for trees	*	2
Protection for all trees, old & young		1
Felling policy	*	1
Diversity is very important	*	1
Policies should be from a bigger perspective		1
Protection of very old trees	*	1
Education, awareness, research and knowledge are key. The relation between the economy, tourism and nature need to be understood. They are not separate, they depend on each other.	*	1

From the interviews, the following overall objectives are derived. Table 23 indicates which suggestions are covert by these objectives. In the criteria (paragraph 4.3) objectives and suggestions are translated into criteria.

- The biodiversity and quality of the tree population must increase or at least be kept equal.
- Threats to the tree population should be reduced
- Governance of Nature laws and regulations should be effective
- Socially and politically the transition to better tree conservation should happen with minimum conflict

The two suggestions, that are not converted into objectives, are elaborated here. The suggestion “Protection for all trees, old & young” is not converted into an objective because the main objective of the tree policy already covers this. The second suggestion, that is not converted into an objective, is “Policies should be from a bigger perspective”. The interviewee described that they believe a tree policy should be a part of a bigger policy. For example, there should be a policy for protecting Prikichi’s (local parakeet). How, where and what tree should be protected, to facilitate the Prikichi’s, should be divined for that policy. This should be done for multiple threatened species on Aruba like the Choco (burrowing owl) and the Dori (frog). Then, based on the Prikichi policy, a tree policy should be derived. This is a great idea, but policies for these threatened species do not exist yet. The threat to trees is so pressing that a policy is necessary now. However, a tree policy should always be a dynamic document. If these policies were to be published, they should affect the tree policy.

4.3. Criteria

Criteria are based on the objectives. Criteria can be found in table 24.

Table 24: Criteria per objective

Objective	Criteria
The biodiversity and quality of the tree population must be kept equal or preferably increased.	No more felling of old trees
	No more felling of rare trees
	Enhance regeneration
Threats to the tree population should be reduced.	Enhance enforcement
	Prevent further fragmentation
	Reduce pollution
	Combat invasive species
	Reduce overgrazing
	Prevent development from damaging the tree population
	Reduce the occurrence of small clearances
	Reduce soil degradation
Governance of Nature laws and regulations should be effective.	Enhance enforcement
	Optimize policy
	Shared tree data
Socially and politically the transition to better tree conservation should happen with minimum conflict.	The connection between economy, tourism and nature should be understood

5. Recommendations

From the research, it can be derived that the position of native trees on Aruba is under great pressure. Several treaties and laws provide protection to native trees on Aruba. Especially the Nature Conservancy Ordinance. Also, policies with great intentions, towards nature and tree conservation, have been published. For tree conservation to prevail efforts must be made to comply with them. The growing awareness about nature conservation, on Aruba, is their greatest strength. For nature conservation is a group effort. Regardless of power, stakeholders with high interest can make a valuable contribution to the growing awareness. Powerful stakeholders are called upon to help continue and increase the protection of native trees, on a management level. 13 activities are recommended to improve native tree protection. Table 25 shows which activities correlate with which activities.

Stakeholders with interest and high influence/power

- DIP
- DOW
- FPNA
- DNM

Stakeholders with high level of interest

- StimAruba
- Santa Rosa
- Ban Lanta y Planta

Table 25: Activity per criteria

Criteria	Activity
No more felling of old trees	2, 8, 9 & 13
No more felling of rare trees	1, 8, 9 & 10
Enhance regeneration	3, 4, 5, 11 & 12
Enhance enforcement	8, 9 & 10
Prevent further fragmentation	& 13
Reduce pollution	11
Combat invasive species	3
Reduce overgrazing	4
Prevent development from damaging the tree population	6, 7, 8 & 9
Reduce the occurrence of small clearances	9 & 12
Reduce soil degradation	All activities that counter vegetation reduction
Enhance enforcement	8, 9 & 10
Optimize policy	6, 7, 8 & 11
Shared tree data	13
Connection between economy, tourism and nature should be understood	12

To conform to the structure of the island description, the recommended activities are divided into recommendations on tree conservation status, recommendations on governance and recommendations on stakeholders. Every recommended activity is elaborated with a description, recommended executor, the goal of the activity and priority. The priority rating is given through one, two or three stars. Three stars equal the highest priority and one star equals a less high priority. However, one star ratings should not be confused with low or no priority. All the proposed activities are necessary steps towards the protection and preservation of native trees. Finally, a paragraph is added to elaborate on the connectivity between the recommended activities.

5.1. Recommendations on Tree Conservation Status

Activity 1: Add 5 species to the protected species list

Priority: *

Goal: To provide protection to all rare tree species.

The protected species list should be supplemented, so all rare species gain the protection of the Nature Conservancy Ordinance.

Table 26: Actions activity 1

Action	Executor
The following five species should be added, to the protected species list, by national decree: • Crossopetalum rhacoma — Beishi di Lama • Croton niveus — Kiviti • Peltophorum acutifolium — Curahout • Pilocarpus goudotianus — Palu Cayente • Sideroxylon obovatum — Palo di Lechi	DNM Aruban Government

Activity 2: Appoint monumental trees

Priority: **

Goal: To protect seed-baring trees and with that the future of the native tree species of Aruba.

Old trees should gain protection, because they provide seeds, higher carbon storage and landscape value. Now, only mature trees from the protected species list or those standing in a nature reserve, gain protection by law. Mature trees should gain protection, regardless of their species. To provide protection to big, full-grown trees, appointing monumental trees can be a solution. Mature trees with high ecological, natural, cultural and landscape value should be added, to the protected species list, by national decree.

Table 27: Actions activity 2

Action	Executor
Appointment of monumental trees through Article 4.2.B of the Nature Conservancy Ordinance	DNM Aruban Government

Activity 3: Combat invasive species

Priority: *

Goal: To prevent the reduction of native tree species by competition with invasive species.

Two alien species should be taken into consideration as a threat: Nim (Azadirachta indica) & Garote di San José (Leucaena leucocephala).

Table 28: Actions activity 3

Action	Executor
The threat of invasive species should be kept away from the nature reserves. These species need to be monitored to make sure they don't move into the nature reserve areas.	FPNA
Park management, makes exceptions to the rule to outplant native trees. Whatever these exceptions are, Nim (Azadirachta indica) and Garote di San José Leucaena leucocephala should never be planted out again.	DOW
Execute the action "Enact legislation regarding invasive and exotic species" from the Nature and Environment Policy Memorandum.	DNM

Activity 4: Implement a goat policy

Priority: ***

Goal: To increase the regeneration of tree species by reducing the pressure from overgrazing.

Cattle goats get released during the daytime, to roam freely to feed on nature. A policy needs to be put into place to reduce the damage of this situation to trees. 30 years of goat management in Christoffel National Park, on Curacao, show an increase in tree and shrub coverage (Hoen, 2021). A policy could be based on Curacao's policy.

Table 29: Actions activity 4

Action	Executor
Develop a policy to reduce pressure from free-roaming goats. • Start a dialogue with the community (focus groups) to find a solution that respects the goat's position in the Aruban culture, but also protects the native trees species from the damage they do.	FPNA DNM Santa Rosa StimAruba

Activity 5: Strengthen the native tree population

Priority: **

Goal: To boost the regeneration of native tree species by increasing the number of individual trees.

Healthy regeneration happens with a healthy tree population. And currently, with the low numbers of individuals for many tree species, regeneration is under pressure. This has been known for years and not interfering with nature's course, does not seem to turn the tide. Seedlings need to be introduced to ensure the existence of these species.

Table 30: Actions activity 5

Action	Executor
Increase the number of rare trees. Reforestation efforts, involving native trees, need to be encouraged and supported.	FPNA Ban Lanta y Planta
Increase the space there is for trees. Appoint more areas where they are protected.	(activity 6 & 7)

5.2. Recommendations on Governance

Activity 6: Specify protective functions in the Spatial Development Plan with Conditions

Priority: *

Goal: To increase the protection of tree populations on Aruba.

The first plan period of the Spatial Development Plan is five years. The Spatial Development Plan can be a tool, to provide more protection to trees. During the revision of the Spatial Development Plan, more protection can be derived, if the protective functions are more thoroughly elaborated. If possible define "the conservation, restoration and development of existing natural, ecological, scenic and cultural-historical values". When these values are elaborated, they derive specific protection.

Table 31: Actions activity 6

Action	Executor
After the plan period of 5 years, try to use the revision to specify the protection of trees within the function of zones	DOW Aruban Government

Activity 7: Add protective qualities to Business park Barcadera

Priority: **

Goal: To increase the protection of trees standing in the business park Barcadera.

Business park Barcadera accommodates a wide range of tree species and holds other ecological value according to the DNM Nature Areas Map (image 4, paragraph 3.3.3.2.). While this area derives barely any protection and is meant for industrial development according to the stratification of the Spatial Development Plan. Native tree species within this area, need more protection.

Table 32: Actions activity 7

Action	Executor
Provide more protection to the ROPV Business park Barcadera zone by either: • Adding, specified, protective functions to the zone Business park Barcadera in the Spatial Development Plan • Adding forested pieces of land, from Business park Barcadera, to the Ecological Main Structure	DOW Aruban Government

Activity 8: Include inspections of smaller lots, through the Build With Nature Policy

Priority: ***

Goal: To grant protection, that already prevails by law, in practice and to reduce the pressure of urban development on trees.

Formerly it was common to issue lots of 750m^2. DOW is now trying to preserve nature by issuing smaller lots in allotment plans. The Build With Nature policy, requires inspections of lots before development, to ensure no endangered species are damaged through development. However, the Build With Nature policy specifies the inspection of equal to, or greater than, 750m^2. To achieve protection to species the inspection of smaller lots must be included.

Table 33: Actions activity 8

Action	Executor
Through the Build With Nature policy, include mandatory inspections on lots smaller than 750 m^2.	DIP DNM Aruban Government

Activity 9: Appoint more BOAs

Priority: ***

Goal: To grant protection, that already prevails by law, in practice.

Laws and policies are in place that already provide a lot of protection to a lot of species. Unfortunately, when those laws are not being enforced, they do not offer any protection in practice. BOAs can reduce pressure on law enforcement. Stakeholders indicate they would love to see more BOAs to help enforcement of nature laws. More civil servants need to be trained to BOAs and trained BOAs must be appointed to a BOA position as soon as possible.

Table 34: Actions activity 9

Action	Executor
Train more civil servants to become a BOA.	Aruban Government
Appointing trained BOAs to a position.	Aruban Government

Activity 10: Appoint BOAs to FPNA

Priority: ***

Goal: To grant protection, that already prevails by law, in practice for the most valuable nature areas.

The nature reserves are the most valuable areas regarding nature conservation, therefor these areas are most protected by law. A lot of rare trees occur within the nature reserves. The enforcement of nature laws in these areas is crucial to the conservation of trees. On short term, the appointment of BOAs, to FPNA, would resolve the problem of lack of law enforcement. A permanent solution would be the appointment of BOAs within the organisation of FPNA.

Table 35: Actions activity 10

Action	Executor
Appoint governmental BOAs to enforce nature laws for FPNA full-time.	Aruban Government
Adjust the law so not just civil servants, but also appointed people can become BOAs	Aruban Government

Activity 11: Create a thinktank/workgroup pollution control

Priority: ***

Goal: To derive a solution for the pressing and growing pollution problem.

The Nature and Environment Policy Memorandum mentions action to the pollution problem of Aruba already (Ministerie van Ruimtelijke Ontwikkeling, Infrastructuur en Milieu', 2018), unfortunately, present-day the issue of pollution is still pressing. The threat of pollution is major and needs a solution based on expertise. A plan must be formulated to address the pollution problem on Aruba.

Table 6: Actions activity 11

Action	Executor
Create a task force to discuss a plan for solving the pollution problem on Aruba. Include (independent) people with expertise.	Aruban Government

5.3. Recommendations to Stakeholders

Activity 12: Enhance the growing awareness

Priority: **

Goal: To accomplish cooperation in nature conservation, to reduce social pressure on law enforcement and to increase social enforcement.

All activities stand or fall with the involvement of all stakeholders and the community. Due to the community being so small, enforcement can be an obstacle (paragraph 3.3.5.). This obstacle however may become Aruba's strength. If the community collectively stand up for the interest of nature, social enforcement could even reduce the pressure on formal law enforcement. It is a great responsibility of the stakeholders to stimulate the growing awareness for nature conservation if the conservation ought to be successful. The relevance of nature conservation should be understood, for the community to care for it.

Table 37: Actions activity 12

Action	Executor
Information campaigns on the value of nature should regard: • Focus on multiple channels to educate several groups within society • Try to reach those who do not seek out this information by themselves (prevent preaching for the choir, situation) • Include governmental departments so those who make the decision, do it well informed • Involve the community in the development of policies	All stakeholders

Activity 13: Create a national tree stock

Priority: **

Goal: To generate systematic maintenance measures and inspections to share knowledge and to detect warnings in time.

The DOW works with a database on green zones, this should include a separate database on trees. Tree management within an urban setting would benefit from a database on trees. The database should include all individual trees standing in the urban setting. Monitoring and maintenance activities could be processed in the tree stock. A tree stock would help in management, protection and research. This database should be shared between all departments of the government and could also help in the appointment of monumental trees.

Table 38: Actions activity 13

Action	Executor
Create a national tree stock database. Preferably shared with FPNA.	DOW DNM

Point of interest:

Lastly a point of interest, regarding trees. A Lot of palm trees can be observed on Aruba, especially in areas that tourist visit (Beach, Centre of Oranjestad, Centre of San Nicolas, Harbour of Oranjestad and West coast tourist area). If Aruba wishes to conserve, restore and develop, not just existing natural and ecological, but also scenic and cultural values, as mentioned in the Spatial Development Plan, it is wise to go back on the decision to plant that many palm trees. Even though palm trees might comply with the views of tourists, of what Aruba should look like, historically speaking this is incorrect. And with the desire to preserve cultural values, native tree species might fit more properly with these views.

5.4. Connection between the activities

Activities with *:	Activities with **:	Activities with ***:
• Activity 1 • Activity 3 • Activity 6	• Activity 2 • Activity 5 • Activity 7 • Activity 12 • Activity 13	• Activity 4 • Activity 8 • Activity 9 • Activity 10 • Activity 11

The activities got a priority rating, which indicates the preference of the order in which the activities should be executed. However, activities with a lower priority rating should not be eliminated. This paragraph shows why. Based on the problem tree, the relevance of all activities is portrayed.

Image 6, shows which activity affects which cause, and with that, which activities are connected through the causes they affect that are connected.

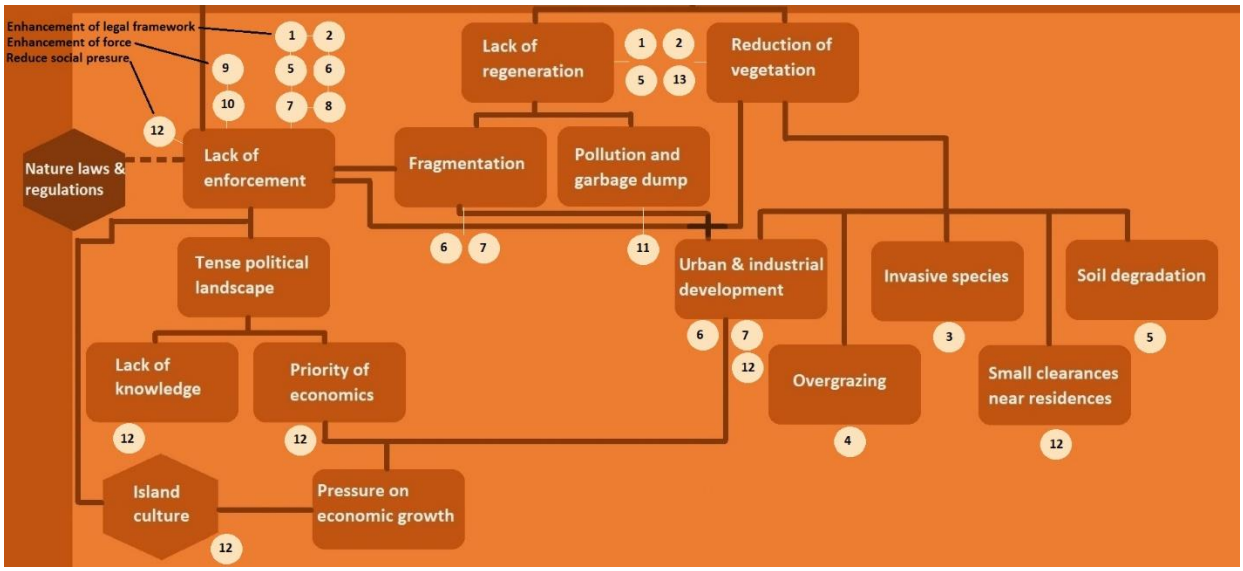


Image 6: Activities that connect with causes in the problem tree

Activity 12 is the activity that affects the most causes. This is also the activity that is hardest to be successfully executed because it is complex to change a communities mindset. However, this activity can have an effect on so many different levels of the cause, that its importance should not be underestimated.

A lot of activities affect the enforcement. This could come across as if not all activities have to be executed to remedy this cause. However, the activities affect three different aspects of the cause, that all can improve enforcement. Activity 1, 2, 5, 6, 7 and 8 all provide a more extensive legal framework. With clear rules, enforcement becomes easier. Activities 9 and 10 enhance the enforcement force. And activity 12 can reduce social pressure on enforcers.

The reduction of vegetation has several causes. All causes have at least one recommended activity to address them. Skipping one of the activities means not addressing a cause. This can result in the continuance of the reduction of vegetation.

Activity 1, 2, 5 and 13 directly affect the two causes high up in the problem tree. These are the two major causes. Still, not addressing the causes below in the problem tree, could result in not resolving these major causes. So these activities cannot replace the activities further below on the problem tree.

By leaving out an activity, one of the causes might not be properly addressed. Failure to perform all activities could result in not fully addressing the problem of “the declining of the tree population”. Not carrying out all activities is therefore not recommended.

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Appendix I: Field form for observations

Date of observation: …… Name observer: ……

Observations number: ……. Area name: ……

General observations	
Area	Vegetation: Trees: Infrastructure: Buildings:
Visible threats to trees	
Comments	

Add pictures:

Appendix II: Results field observations

I. Observations

During the observations local tree names where used. Total amount of observations: 53. During observations some trees where observed more often than others. A total of 53 observation where done in 15 different zones. For every observation a record was made of trees occurring there, visible threats to trees, a general description of the area and remarks

Table 39: Observations per zone

Zone	Amount of observations
Nature reserve	8
Nature and Landscape	5
Beach	5
Urban residential area	5
Residential area with value	10
Rural area	4
Centre of Oranjestad	3
Harbour of Oranjestad	1
Centre of San Nicolas	2
West coast tourist area	3
East coast tourist area	1
Airport	1
Business park Barcadera	1
Business park San Nicolas	2
Transformation area	2

“Marine areas” and “marine zones” are not observed because these areas contain only waters, no land area. Also no observation where done on the coral island along the south coast, due to accessibility. Depending on the location, the island are either part of “nature and landscape” or “nature reserve” in the ROPV.

Nature reserve

8 observations observation numbers: 3, 7, 10, 11, 50, 51, 52 and 53

The nature reserves cannot be summarized in one general description. Big trees, small trees and big shrubs all occur within the nature reserves. In the reserves on Westpunt near the lighthouse and Saliña Noord trees barely occur. These areas are open and if tree species occur they are mostly small shrubs. In Parkietenbos and Spanish Lagoon the forest vegetation consist of mangrove species, and in the park a wide range of tree species can be found, as shrubs and as full grown trees. Side note: remarkably no (visual) threats have been observed within the Arikok National Park and the adjacent Spanish lagoon. In the smaller secluded nature reserves threats where observed.

Trees:

- Mangel tam
- Kwihi (shrub)
- Wayaca
- Hubada (shrub) (dominant at Lighthouse)
- Druif (shrub)
- Fofoti (shrub) (dominant at Bubali)
- Mangel
- Kenepa
- Watakeli
- Pan cu Keshi
- Huliba
- Cawara
- Calbas
- Mansaniya
- Mangel preto

Threats:

- Clearance
- Pressure from landfill (Parkietenbos is next to the landfill where small fire occurred during observation)
- Erosion
- Pollution (adjacent to Bubali: RWZI is dumping unpurified water into Bubali lake)
- Fragmentation

Nature and landscape

5 observations observation numbers: 6, 12, 15, 31 and 49

The area, along the north-side of the island, within the nature and landscape plot have the same general look. Vegetation does not grown higher than approximately 1,5 meter. Closer to the coastline the vegetation cover declines and shrubs grow less high. In this area a lot of dirt roads occur, which are being used by a lot of ATV's and UTV's (tours). The paths are not marked. Multiple paths occur parallel to each other. East-side of Arikok National Park conforms to the same view. Small nature and landscape plots also occur within other areas. A plot in the high rise hotel area was observed, signature park. The general view of this area is much different from the areas on the north-side. In signature park a dense shrub vegetation occurs. This small area seemed to be threatened by development of small structures like a parking lot and a basketball court.

Trees:

- Kwihi (as shrub on north-side)
- Hubada (as shrub on north-side)
- Druif (shrub)
- Nim

Threats:

- Erosion/soil degradation
- Pressure from tourism (could affect erosion/soil degradation)
- Garbage dump
- Pressure from hight rise hotel area

Beach

5 observations observation numbers: 1, 2, 9, 19 and 20

Beaches are in general open areas with either sand or bare rocks. Often some solitaire trees occur, useful for shade. On some beaches they are small trees and on others big full grown trees. Surfside beach seem to be different from the others. There are trees covering the beach here, like a forest.

Trees:

- Mangel tam
- Druif
- Wayaca
- Fofoti
- Kwihi
- Hubada
- Mangel preto
- Palm trees

Threats:

- Fragmentation
- No regeneration
- Pressure from business park (beaches adjacent Barcadera are vulnerable to development and pollution from Barcadera)

Urban residential area

5 observations observation numbers: 36, 38, 39, 43 and 44

In the urban residential area the landscape mostly contains houses and commercial buildings. Mainly low-rise. Trees occur in green zones and sometimes as solitaire trees through streets. Smaller green zones are often empty lots with uncultivated vegetation. Bigger green zones can be found in “rooien”.

Trees:

- Kwihi
- Hubada
- Huliba
- Garote di San Jose
- Nim (above line occur frequently)
- Wayaca (shrub)
- Pan cu Keshi
- Druif (shrub)
- Apeldam
- Calbas
- Watapana
- Morenga

Threats:

- Urban development
- Invasive species (between residences Nim and Garote di San Jose overrun the area)
- Fragmentation
- Garbage dump

Residential area with value

10 observations observation numbers: 32, 33, 34, 35, 37, 40, 41, 42, 47 and 48

In most areas (with the exception of the area near Sero Colorado, observation 42) these landscapes are typical residential areas. The view is dominated with residences, trees in gardens and alongside roads and some commercial buildings. Most buildings in these areas are low rise. Green zones sometimes occur on small lots, and sometimes contain bigger more park like areas. The area that is different from this view, is the area in San Nicolas, south-east of Fortheuvelstraat. This area is mostly undeveloped and dominated with shrub vegetation.

Trees:

- Kwihi
- Wayaca
- Hubada (shrub) (dominant)
- Pan cu Keshi
- Huliba

Threats:

- Urban development
- Invasive species (mostly Nim)

- Druif (shrub)
- Watapana
- Calbas
- Palisia blanco (3 individuals)
- Nim (mostly near private property)
- Palm trees
- Garote di San Jose
- Morenga

Rural area

4 observations observation numbers: 29, 30, 45 and 46

In the rural areas lots of forest like/high shrub vegetation occurs. Natural area alternates with residences, private properties and cunucu's. From the observations it seems like the rural areas near San Nicolas accommodate less private properties than the areas around Oranjestad.

Trees:

- Kwihi (dominant)
- Hubada (dominant)
- Huliba (dominant)
- Wayaca
- Watapana
- Pan cu Keshi
- Palisia Blanco (4 individuals)
- Calbas
- Garote di San Jose
- Fototi
- Nim (on and near private properties)
- Morenga (on and near private properties)

Threats:

- Urban development
- Small clearance near residences (for parking space maybe)
- Clearance (for construction maybe)
- Garbage dump

Centre of Oranjestad

3 observations observation numbers: 21, 22 and 23

The observations from the centre of Oranjestad portray a landscape dominated by buildings. Mostly houses and commercial buildings. Trees occur mostly on private properties (gardens) or on small patches. Most green is cultivated. Trees are often cultivated. A lot of trees stand solitaire on a small piece of soil, surrounded by pavement. The fact that the area is build and paved full no natural regeneration is possible around most trees. Trees also occur on what seem to be empty lots, maybe these are meant for construction.

Trees:

- Palm trees
- Nim
- Barba di Jonkuman
- Karawara Spaña
- Cordia boiserie (not on the list)
- Tabebuia rosea (not on the list)

Threats:

- Urban development
- Fragmentation
- No regeneration
- Pollution

- Kwihi
- Wayaca
- Huliba

Harbour of Oranjestad

1 observation observation number: 24

The harbour is a partially developed (east side). The developed area contains lots of commercial buildings. All vegetation occurring here seems cultivated. There is low cut grass, trimmed bushes and palm trees. On the westside a big paved/concrete area occurs where festivals seem to be held. In the middle a big fence surrounds the area. In this area are undeveloped patches covered with vegetation. Mainly shrubs.

Trees:

- Druif (shrub)
- Garote di San Jose (shrub)
- Huliba (shrub)
- Palm trees

Threats:

- Urban development

Centre of San Nicolas

2 observations observation numbers: 17 and 18

The city centre of San Nicolas is mainly covert with buildings and roads. Green/vegetation occur in small zones. Often they seem neglected/not cultivated. Also roadsides seem less maintained. This shows in the fact that empty lots are often overrun with Garote di San Jose and Nim (shrubs).

Trees:

- Kwihi
- Garote di San Jose
- Nim
- Palm trees (sporadic)
- Kenepa
- Apeldam

Threats:

- Urban development
- Fragmentation
- Invasive species
- No regeneration

West coast tourist area

3 observations observation numbers: 25 and 26

The tourist area on the west coast is highly developed and cultivated. In the high rise and low rise hotel area, most ground is covered with buildings and infrastructure. Vegetation occurs here highly cultivated on hotel properties or as big trees alongside the road. A bit further west Tierra del Sol cover a big part of the tourist area. This is a fenced off area which feels like a small village including a golf course. In this area a lot more vegetation occurs, but it is all cultivated. Trees occur alongside the edge of the area or highly cultivated solitaire. (on the east side of this area, which is closed off, it seems like empty lots occur for cultivation. It seems lots of shrubs occur here.) It is noticeable that roadsides and roundabouts in the tourist area seems way more cultivated/way greener than on he rest of the island. Sidenote: biggest threat of the hotel area is that it would start developing into adjacent (natural) areas.

Trees:

- Kwihi (dominant)
- Pan cu keshi
- Druif
- Hubada
- Palm trees

Threats:

- Urban development
- (threats are small in the hotel area because is barely any nature left)
- Invasive species (if cultivation stops)

East coast tourist area

1 observation observation number: 13

The tourist area on the east side is not open for visitors yet. On the west side of the area the construction of big hotels are in development. This is a big cleared construction side. The east side covered in vegetation. Vegetation that occurs here is no higher than 1 meter.

Trees:

- No trees, only shrubs

Threats:

- Clearance (for construction, these threats are to nature in general, not to trees considering trees do not occur here)

Airport

1 observation observation number: 4

This observation could only take place through the fence from the outside in, due to area being closed for public. There are buildings on the terrain, roads and landing strips and some low vegetation. It seems all vegetation is kept low. Vegetation seem to consist of herbs and grasses. Some very small shrub seedlings.

Trees:

- Only seedling shrubs

Threats:

- Clearance

Business park Barcadera

1 observations observation numbers: 5

Only one observation point is measured in this area because the overall view was quite similar through the entire business park. Trees where observed while driving to get a wide range of species occurring here. In this area land with shrub vegetation alternate with industrial developed land. Of the shrub land about 70 % is covert with high shrubs and small trees. Also some big trees occur alongside the roads.

Trees:

- Kwihi
- Hubada
- Wayaca
- Druif
- Nim
- Garote di San Jose (above line occur frequently)
- Watapana

Threats:

- Industrial development (clearance of shrubland)
- Pollution

- Beishi di Lama (shrub)
- Huliba
- Mata Pisca (shrub)
- Pan cu Keshi

Business park San Nicolas

2 observations observation numbers: 14 and 16

Business park San Nicolas is surrounded by a big fence. On most places it is a mall where you cannot look through. This 2 observations could only take place through the fence from the outside in, due to area being closed for public. Most of the area is covered with big refinery constructions. A lot of concrete covers the area grounds. There seem to be open areas as well which are mostly covered with grasses. Occasionally big shrubs occur. Around a parking lot it seems big trees occur.

Trees:

- Wayaca (shrubs)
- Huliba (shrubs)
- Kwihi
- Druif
- Nim (shrubs)

Threats:

- Pollution
- Industrial development

Transformation area

2 observations observation numbers: 25 and 26

The transformation area seems to be a business park. No big industry occurs here but commercial buildings of all sorts are located here. Buildings dominate this area. Nature occurs sporadic. Either cultivated or on neglected lots.

Trees:

- Palm trees
- Kwihi
- Hubada (shrub)
- Pan cu Keshi

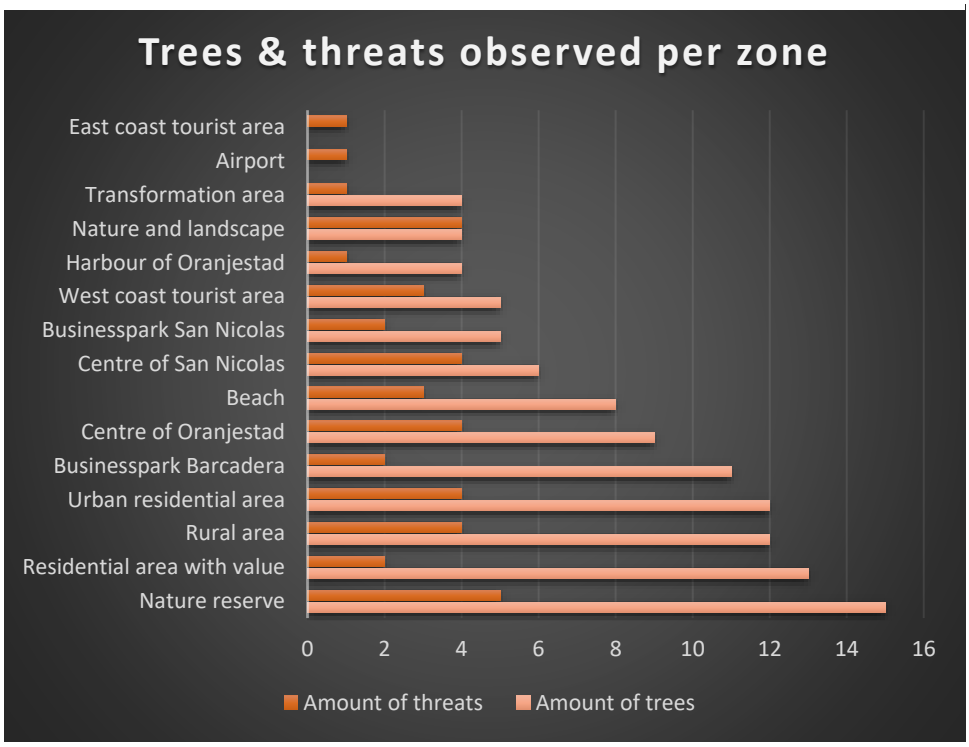
Threats:

- Urban development

II. Analysis

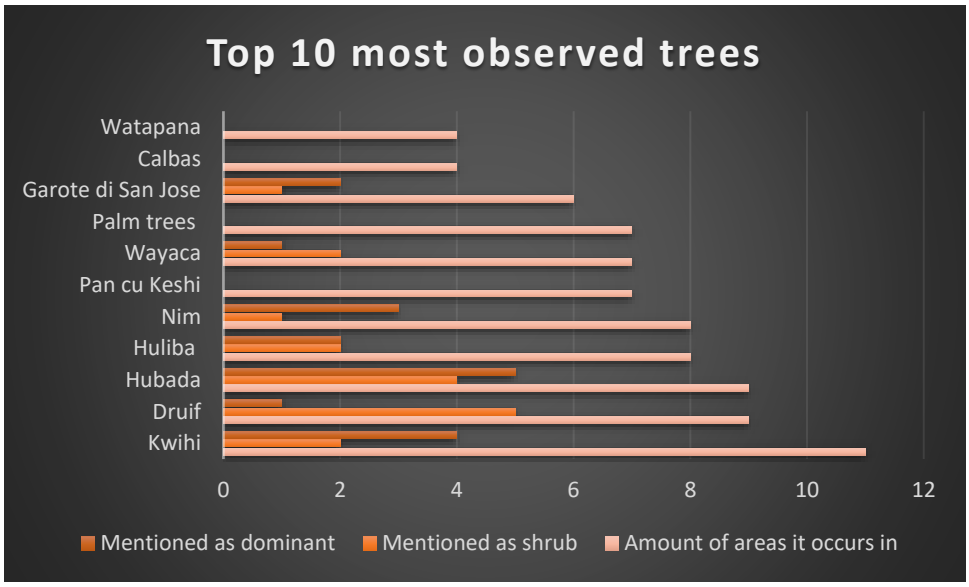
During observations some trees where observed more often than others. A total of 53 observation where done in 15 different zones. For every observation a record was made of trees occurring there, visible threats to trees, a general description of the area and remarks. In figure 5 the amount of different trees and threats can be found. The observer found it relevant to mention in 5 zones, which tree (species) were dominant. Dominance of a tree was only observed in area where a coherent vegetation occurred. Areas where trees and shrubs where scattered through the area, the dominant species was not mentioned. Most different trees were found in “Nature reserve” but also in “Residential area with value”, “Urban residential area”, “Rural area” and “Business park Barcadera” a lot of different trees where observed. In two zones, “East coast tourist area” and “Airport”, no trees where observed. The amount of threats observed per zone are various.

Figure 5: Trees & threats observed per zone



The top ten trees, which occur in the most areas can be found in figure 6. Kiwhi occurs in 11 of the in total 15 areas that were observed, this means they were observed in 73% of the areas. Other most occurring trees, according to the observations, are Druif, Hubada, Huliba and Nim. Of these Druif occurred most as a shrub, 5 out of the 9 times (see table 40). Hudaba was most described as dominant. Of the top ten most observed trees, three are alien species.

Figure 6: Top 10 most observed trees



A total of 28 tree species where noticed during observations. 18 of them are native species and 10 are alien species. From the 18 native tree species observed, 5 are on the protected species list of the Aruban government. Kwihi, Druif, Hubada an Huliba seem to occur frequently. Hubada and Druif also occur often as shrubs instead of trees.

From the observed alien species trees al, except from Morenga, can be found is a city centre (“Centre of Oranjestad” or “Centre of San Nicolas”). Nim is the most occurring alien species, being observed in 8 different zones. Nim is mentioned as part of a dominant vegetation three times, and Garote di San Jose twice. Both residential areas, “Urban residential area” and “Residential area with value”, accommodate 4 different alien species. The nature zones, “nature reserve” and “nature and landscape”, occur only twice in table 41. Because most species occur in city centres and residential areas, while barely any alien species were observed in nature areas, it seems the alien species thrive more where people are.

Table 40: Native trees observed per area

Scientific name:	Local name:	Nature reserve	Nature and landscape	Beach	Urban redidential area	Residential area with value	Rural area	Centre of Oranjestad	Harbour of Oranjestad	Centre of San Nicolas	West coast tourist are	East coast tourist area	Airport	Businesspark Barcadera	Business park San Nicolas	Transformation area	
Amount of areas the tree species occur in		2		1		2		4		9		3		1		4	
Avicennia germinans	Mangel preto	*		*													
Bourreria succulenta	Watakeli	*															
Bursera karsteniana	Palisia Blanco (7 individuals)					*	*										
Caesalpinia coriaria	Watapana				*	*	*							*			
Coccoloba uvifera	Druif	*	*	*	*	*			*		*			*	*		
Conocarpus erectus	Fofoti	*		*			*										
Cordia dentata	Cawara	*															
Crescentia cujete	Calbas	*			*	*	*										
Crossopetalum rhacoma	Beishi di Lama													*			
Guaiacum officinale	Wayaca	*		*	*	*	*	*						*	*		
Hippomane mancinella	Mansaniya	*															
Jacquinia arborea	Mata Pisca													*			
Laguncularia racemosa	Mangel	*															
Pithecellobium anguis-cati	Pan cu Keshi	*			*	*	*				*			*		7	*
Prosopis juliflora	Kwihi	*	*		*	*	*	*		*	*			*	*	11	*
Quadrella odoratissima	Huliba	*			*	*	*	*	*		*			*	*	9	
Rhizophora mangle	Mangel tam	*		*												2	
Vachellia tortuosa	Hubada	*	*	*	*	*	*				*			*		9	*
Amount of tree species observed in the area:		14	3	6	8	9	9	3	2	1	5	0	0	9	4		3

Table 41: Alien trees observed per area

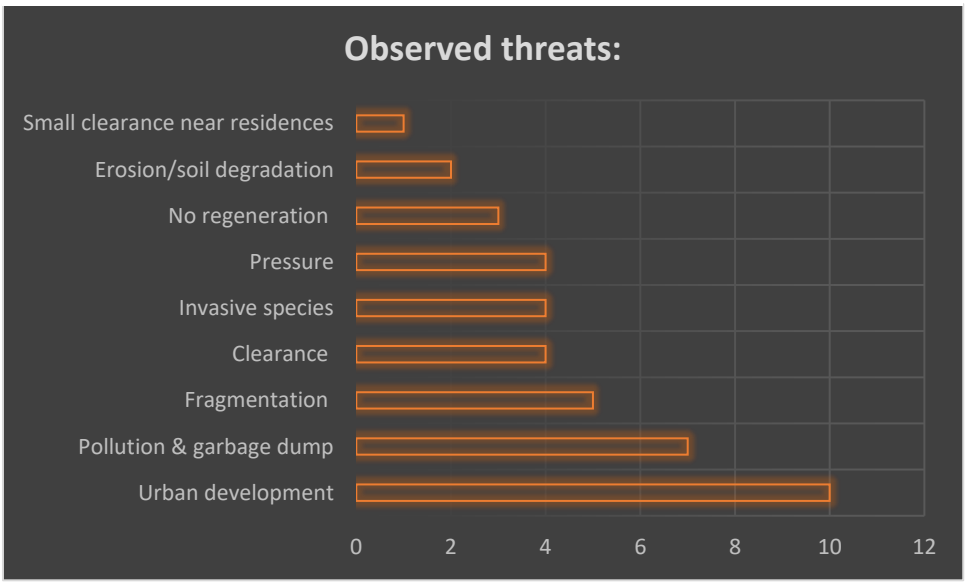
Amount of areas the tree species occur in:		1	8	1	1	6	2	3	1	2	6	
Scientific name:	**Local name:**											
Albizia lebbeck	Barba di Jonkuman	*										1
Azadirachta indica	Nim		*									1
Cordia boiserie				*								1
Cordia sebestena	Karawara Spañia	*										1
Leucaena leucocephala	Garote di San Jose					*	*					6
Melicoccus bijugatus	Kenepa							*				2
Moringa oleifera	Morenga											3
Tabebuia rosea												1
Ziziphus spina-christi	Apeldam									*	*	5
	Palm trees										*	2
Amount of tree species observed in the area:		1	1	1	0	1	1	1	0	1	2	

In table 42 an overview of the observed threats is portrayed. Urban development is the most occurring threat, according to the observation. In 8 zones this threat is recorded. When adding industrial development to this, it can be said that 10 of the 15 zones are threatened by development. Garbage dump is a form of pollution. When adding these two threats together, pollution occurs in 7 zones. Fragmentation, pollution, clearance and invasive species are also mentioned often as threats. At the bottom of the list of threats, it seems remarkable that “pressure” from different specific domains are mentioned. Human activity is the common threat here. In figure 7 the different threats are portrayed in a diagram.

Table 42: Overview threats

Threats	Nature reserve	Nature and landscape	Beach	Urban redidential area	Residential area with value	Rural area	Centre of Oranjestad	Harbour of Oranjestad	Centre of San Nicolas	West coast tourist are	East coast tourist area	Airport	Business park Barcadera	Business park San Nicolas	Transformation area	Amount of zones the threat occur in:
Development				*	*	*	*	*	*	*			*	*	*	10
Fragmentation	*		*	*			*		*							5
Pollution & garbage dump	*	*		*		*	*						*	*		7
Clearance	*					*					*	*				4
Invasive species				*	*				*	*						4
No regeneration			*				*		*							3
Erosion/soil degradation	*	*														2
Small clearance near residences						*										1
Pressure	*	**	*													4
Amount of threats per zone:	5	4	3	4	2	4	4	1	4	2	1	1	2	2	1	

Figure 7: Observed threats



Appendix III: Results interviews

This chapter shows an analyses on the interviews held for this policy. In total 7 interviews were held. 6 out of 7 interviews were recorded. 6 out of 7 interviews took place face to face. Unfortunately the seventh had to be rescheduled due to illness. Luckily this interview could take place through Microsoft Teams when the interviewee was recovered. All interviewees were questioned about three subjects:

- The social political landscape on Aruba
- Enforcement of nature laws on Aruba
- Description of a stakeholder

Each interviewee was asked to give a description about the social political landscape and the enforcement of nature laws on Aruba. Besides they were each asked to describe a different stakeholder mentioned in the stakeholder analysis. In paragraph I statements are portrayed that were made by several different interviewees. Also statement are highlighted that seem to be relevant for the subjects. In paragraph II summaries per interview per subject can be found. The interviews are anonymized. Two extra subject are defined in the analyses to create a more clear overview. All interviewees mentioned the tree policy, therefor a paragraph about this is added. And a paragraph about "other", in which statements are highlighted that do not fit the previous subjects. In the subject stakeholders, it is not mentioned which interview made the statements.

I. Analyses

Social political landscape

Table 43: Social political landscape

Positive or negative statements	Statements	Interviews this is mentioned in
Positive	interviewees mentioning that there is a growing attention for nature conservation. Within society there is a growing demand for nature solutions, but not always from an nature conservation perspective. More awareness with the younger generation. Politically the awareness is growing.	• Interview 1 • Interview 2 • Interview 6 • Interview 7
Negative	But the growing awareness is still in the beginning stage and needs to grow more to make a difference.	• Interview 1 • Interview 2 • Interview 6 • Interview 7
Negative	2 interviewees mention there is no interest or priority for nature (conservation) in the current political landscape.	• Interview 3 • Interview 5
Negative	3 interviewees mention that there is missing expertise. Not everybody is aware of their tasks. But also the knowledge within organisation on how to deal with environmental issues seems to be missing. It is mentioned that education on a professional level is necessary.	• Interview 1 • Interview 4 • Interview 6
Negative	3 interviewees mention that culturally speaking trees can be seen as a burden on Aruba. People prefer their property to be "clean" and tidy. So no leaves in the yard. Besides, if a tree loses flowers of its leaves (non-evergreen trees), they lose their function.	• Interview 1 • Interview 4 (enforcement) • Interview 6
Positive	3 interviewees mention the new minister of nature. In previous parliaments this position did not exist. The appointment of this minister is seen as a development towards better nature conservation.	• Interview 2 • Interview 4 • Interview 6
Negative	4 interviewees mention the big focus on expanding economy. With this statement often is mentioned that the priority lies	• Interview 2 • Interview 3 • Interview 6 (tree policy)

	more with economic growth than nature conservation. These two subjects are in disbalance.	• Interview 7

Relevant statement about the social political landscape:

- There is a disconnect between people and nature – interview 1
- Politic landscape clearly explained – interview 2
- Island culture, where it is hard to enforce (also socially) due to small society – interview 5 & interview 4 enforcement

Enforcement

Table 7: Enforcement

Statements	Interviews this is mentioned in
5 interviewees mentioned that enforcement of nature laws does not happen on Aruba right now. The other two do not contradict this, they stated that they lack knowledge about the subject.	• Interview 1 • Interview 2 • Interview 3 • Interview 4 • Interview 7
2 interviewees mentioned that rangers do not have the ability to enforce nature laws within the nature reserves. But should.	• Interview 1 • Interview 2
2 interviewees mention that a big problem with the nature laws is that a person has to be caught in the act. Due to the lack of enforcement, this does not happen and nature gets destroyed. Police says this is due to the lack of capacity.	• Interview 2 • Interview 7
3 interviewees mention that reporting a crime while it's happening does not result a response from the police or law enforcement. They witnessed this first hand.	• Interview 2 • Interview 3 • Interview 4

Relevant statement about enforcement:

- It is forbitten (according to article 4 of the Nature Conservancy Ordinance) to partially remove a part of protected species. This is a broad definition. This could mean it is not allowed to take a fruit from a tree or cactus. There should be a waiver to exclude this but for now that doesn't exist. - interview 5

Tree policy

Table 8: Tree policy

Statements	Interviews this is mentioned in
Al 7 interviewees mentioned that a tree policy is relevant on Aruba	• Interview 1 • Interview 2 • Interview 3 • Interview 4 • Interview 5 • Interview 6 • Interview 7

Relevant statement about the tree policy:

- Things that should be in a tree policy:
  - Protection for all trees – interview 2
  - Creating more trees, more space for trees – interview 2, 3
  - Felling policy – interview 3
  - Improvement of enforcement – interview 3, 4, 6

II. Summaries of the interviews per subject

Social political landscape

Interview 1:

- Attention to nature conservation is growing. For now mostly the attention to “cuddly” or cute nature.
- Hurdles within nature conservation right now on Aruba are that not everybody is aware of their task and not everybody executes the task they have.
- There is growing demand for nature within the society but, for now, mostly from the perspective of needing a service. For example they want a hedge to separate private property, this increases the amount of trees but that is not their goal perse.
- The typical Aruban citizen perverse their property to be clean and tidy. This results in cleared properties with little vegetation. The wish not to hove leaf’s in their yard, causes a lot of people to cut down trees and shrubs.
- There is a disconnect between nature and (some) tree species. When a tree does not flower anymore, loses leaf’s or loses usability, people don’t like them anymore. Trees can be perceived as a burden.
- After commotion about trimming canopies in the Spanish Lagoon for the visit of Prinses Beatrix in 2017, the pressure was high enough to collaborate for DOW, FPNA and DNM to create a green policy. This however never finalized successfully.

Interview 2:

- Describes the social political landscape as tense.
- Politics resemble the duality of the society on Aruba. There are two major political streams. It’s either one or the other that is governing. Its either conservative or progressive.
- The streams alternate, like a circle. Like they come in waves. Always as a reaction to a big societal event. So after the financial crisis on 2009 an progressive wave came. But after a lot of mismanagement and corruption the conservative wave came back.
- Progressive governments are more “outward”. More international and more open to get investors. Conservative governments are more internal, less international and less open.
- Progressive government is more focused on sustainability, renewable resources and climate change. Not perse on nature.
- The conservative party sees nature as part of culture. Culture is important to them, so some nature does get protection but not from a nature perspective.
- The current government however has included a small, nature conscious party. This makes that for the first time ever the government has a minister of nature. Before they only had a minister of environment. This brings a different (positive) dynamic. → nature is more on the agenda
- Addicted to the current economic model of expanding tourist sector without creating high quality jobs.
- ATA researched that grow of tourist sector will lower quality and income. But it is eventually a political decision.
- Increasing awareness is important!

Social landscape:

- Voters: generally conservatives: workers, nationalist, less educated, local native Arubans. Progressives: not always more educated, more diverse backgrounds.

- Economy: majority of people live on minimum wage while cost of living are very high. Trying to survive. Need multiple jobs. → survival mindset, they don't have time for nature (generalized view).
- Growing tourist sector is seen as growing job opportunity
- Group that is against grow is not big enough to make/demand a change yet.

Interview 3:

- Feels like the government mainly focusses on economy
- Example: No help from DNM and DLVV during the start-up of Ban Lanta y Planta
- No enforcement = a sign of no interest
- Social circle seems involved with nature. They hate to see nature disappear for urban or economic development. If this is an accurate observation they don't know because it might be caused by their surrounding of nature conscious people.

Interview 4:

- The government should provide better information about laws and regulation to society. Lots of people don't know they have the right to review new laws and regulation for a short period before decisions are made, how are people supposed to object if they don't know there is a new paper to review in the first place.
- Information on how to handle nature (regarding wild camping during eastern) does not seem to reach the people. Unknown why. Is it because they are too lazy to read the front page of the paper, is it because they don't care, is it because they don't understand, is it because they know they're not going to get punished?
- DNM gives advises but these are without obligations. It is insecure if the advises are going to be followed up.
- The knowledge often seems to be missing. Expertise on how to handle big environmental issues (like cleaning the landfill) misses often within the small government. They need help from bigger countries of organisations.
- Good development that there is now a minister of nature.
- Thinks it is relevant what the Dutch government involves themselves in Arubas policies and laws. The Netherlands should share knowledge and students/researchers to help Aruba.

Interview 5:

- Believes that nature as well as culture are very irrelevant subjects politically.
- Aruba is a small island with a small community. You should not ignore the fact that employment is a big issue here. so yeah it nature protection is lacking but I have sympathy for that.
- It is not my role to inform the government they should do better. Not my place. Not to the government but also not to for example my neighbour.
- From own experience: I've seen it (though research and involvement) on other small islands as well. Creating a support base to address a polluter, a farmer, a company, etc. when you have a big community on a big piece of land is easy. Because it is anonymous. But making the same difference within a small community, like Honduras or Hawaii, is hard to do. When it is your neighbour who, for example, hunts of pollutes, its way harder to address them because you don't want to provoke a conflict. If you are an enforcer, and you enforce something on someone, that could be you neighbour of your family member. This makes it way harder.
    - He knows no solution to this problem.

Interview 6:

- Experiences struggle within the organisations and politics, between nature conscious people and les conscious people.
- Island life = everybody has a single storey house, with a big garden. Preferably a lot of at least 600 square meters. Lots of 300 square meters are not taken seriously. That is perceived as small.
    - People are loud and therefor prefer to have space. Also because of the mixture of different cultures the big lots are preferred so you can do whatever you like without being judges by neighbours.
- To start building in height and protecting land area is a mindset shift that is happening. Younger generations seem more perceptible for high rise solutions. Seem to understand easier why this is necessary.
- The truth is, nature conservation requires a higher cost. Because of this, everybody should get proper education to understand why this is worth it.
- At official level the knowledge/education is lacking. When you don't know how to protect nature, you can't execute protection.
- Younger generations are more aware of the relevance of nature conservation
- Political awareness on this subject is growing. But there needs to be so much more education.
    - Examples: there is for the first time ever Aruba has a minister of nature
    - This year, for the first time, there was a forum organised (on rights of nature) on earth day.
- Growing social awareness:
    - The involvement of ABC.
    - The founding of TortugAruba
- Positive about changes. The awareness is growing. But it need to grow faster. Even though good developments take place, other sectors are still growing at the cost of nature.
- In the political arena it is still hard to create support base. The egos of politicians are big and they still love to brag with big development projects.
- Happy island culture =They life each day as if it's the last. Therefor there is little care for the future.
- People are too lazy to sweep their gardens that's why they don't have trees in them. This mindset needs to change.

Interview 7:

- Awareness about nature conservation is starting to grow a little bit within society and within politics. There needs to be more commitment to the cause.
- An environmental legislation is necessary. This would also make it more easy for enforcement to act.
- Awareness about the water quality is growing.
- Politically economic growth is always more important than nature.

Enforcement

Interview 1:

- Mentions that the DNM has one qualified BOA. 3 others are trained but not officially appointed by the government therefor they are not allowed to work as BOAs.
- Police is qualified to enforce nature laws. They are often not competent because they lack knowledge.
    - They can however ask advice by organisations like the DNM.
- Enforcement of nature laws do not happen for now. They are not ready yet.
    - Rangers in the park are not allowed and qualified to enforce.
    - Only thing that needs to happen is a change in the law from “geinformeerde ambtenareren” to “geinfomeerde mensen” because this would open the door for non-governmental BOAs to be appointed as well.

Interview 2:

- Enforcement of nature laws is nothing. Non existing on Aruba.
- Park rangers have no authority to enforce laws within the nature reserves. They have tried but only governmental civil servants can be appointed to BOA according to Aruban law.
    - Their solution: either appoint two governmental BOAs to work for the park areas solely or change the law so non-governmental people can be appointed to BOAs.
- Police, bureau city inspection and DNM do have authority to enforce law
- Nature law: you have to be caught in the act. This does not work in practise. police has their hands full.
- When we see a law being broken (someone driving, cycling or riding a horse on white sand for example) we call the police. Police never shows. People get away with it. Nature suffers.
- Example of mangroves: the jurist witnessed a case of mangroves being destroyed. She informs DNM, they do not take the case, nothing happens.
- Police says they have their hands full. They have no time to enforce nature laws.
- As reaction to the interviewer saying “there is a lot of police presence on the streets, so why are they not catching people in the act”: it’s not a priority.
- Lack of enforcement causes lack of motivation to do good.
- They see nature being destroyed as a result of no enforcement.
- Practises that are socially accepted, like letting goats roam freely, will know no social enforcement.

Interview 3:

- Mentions not seeing any enforcement of nature laws.
- When nature is already destroyed, prosecution happen, only if a citizen file charges. And the damage is already done by then
- Reporting crimes (against nature) while happening do not result responding.
    - Therefor do not get enforced
- Example: destroyed corridor next to The Mill Hotel, belonging to “natuur en landschap” on the ROPV.

Interview 4:

- Sees that laws are being ignored and no enforcement takes place.

- Sees that if you question someone about clearing a property that they do not know (do not seem to know) the existing rules.
- Witnessed a protected tree (Palisia cora) being cut down.
    - Lack of supervision
- Example: wild camping on eastern this year. DOW does give some information on the rules which are that it's not allowed to clear any vegetation. But citizens prefer land to be clean. Person witnessed citizens clearing vegetation with a small tractor. He films it and sends it to a contact of him in the government with the question what is going to be done, and the answer is, nothing the damage is already done now.
- Mentioned the island is small. everybody knows each other. This had a negative effect on enforcement. People look away.
- Enforcement is so super relevant

Interview 5:

- Authority for CITES is different on Aruba compared to the other island. It is divided. The authority on fauna is placed with "veterinaire dienst" and the authority on CITES flora is places with DLVV.
- CITES is cooperated in the Nature Conservancy Ordinance.
- At the border customs is responsible for checking if CITES species are being smuggled in or out. If they have the expertise for this, could the interviewee not judge.
- Addressed that it is forbitten (according to article 4 of the Nature Conservancy Ordinance) to partially remove a part of protected species. This is a broad definition. This could mean it is not allowed to take a fruit from a tree or cactus. There should be a waiver to exclude this but for now that doesn't exist.
- On enforcement of other nature laws they do not have knowledge. They made no statements on this subject.

Interview 6:

- No specific knowledge on enforcement of nature laws
- Do know that DIP doesn't have any BOAs, and therefore no enforcement powers. This is common knowledge and some people abuse this.
    - Not all people act out of "I know I'm not going to be punished" some people just don't know there are breaking rules and damaging nature.

Interview 7:

- Enforcement of nature laws does not take place at all.
- According to them THIS is the big problem. The lack of enforcement.
- Lack of capacity is the cause
- Thinks that a department, specifically focused on nature law enforcement is needed.
- People need to be caught in the act:
    - Example: the RWZI cannot process the amount of dirty water coming in. the government can't stop the inflow, and can't pay for a new, bigger, plant. So they dump impurified water illegally. (not really dump but it has to flow out before it is purified because of the capacity). Nothing is being done because they need to be caught in the act, tested while it is being dumped, to enforce laws on them.

Tree policy

Interview 1:

- A tree policy is useful.
    - Prefers policy to be from bigger perspectives and after that incorporate trees
    - For example: make a policy to protect Prikichi's and incorporate how trees should be part of that

Interview 2:

- A tree policy is necessary to protect all trees. Not only the old ones but also the young ones. For the next generation.
- Creating new trees, creating space for new trees.
- And diversity is very important
- Protecting trees is very important because protecting nature is very important. The whole system (of nature) needs protection.
- Expansion of industries harming nature should stop. Nature is protected by law but the fear is that this can be reversed if there is enough pressure. So education, awareness, research and knowledge are key. The relation between economy, tourism and nature need to be understood. They are not separate, they depend on each other.

Interview 3:

- A tree policy is very useful and necessary to protect the few remaining trees.
- Subjects that need to be incorporated in a tree policy:
    - A felling policy
    - Improvement of enforcement
    - Active planting

Interview 4:

- A tree policy is useful because there are so many different laws that can effect a tree but it is sometimes unclear how to deal with different situations (like trees that are not on the protection list of the "natuur beschermingsverordening" and grow on lots smaller than 750 square meter, how are those being protected)
- There should be targeted policy because for now it is unclear if laws are being followed and enforced.
- Tree laws and tree policy are crucial and should be dynamic. The situation changes constantly and so should our approach to conservation be.
- Is in favour of closing of areas for protection of trees because they have seen trees disappear from the wild through the years.

Interview 5:

- A tree policy is relevant.

Interview 6:

- A tree policy is without a doubt necessary
- Space is scarce, because Aruba is small, and economic development goes fast and does not stop. Nature is scarce and not all vegetation stand on protected land.

- The Nature Conservancy Ordinance, protects some trees but not all species. So a 100 year old tree (such old trees do not often occur on Aruba) is not perse save.
- A policy on how to deal with this, does not exist. While there is a need for this.
- We need guidelines and policies so we can back up decisions. We need a baseline of what species thrive where.

Interview 7:

- Yes a policy is necessary to protect trees.
- Trees need more protection because people are used to clearing an area as soon as they receive a plot.

Stakeholders

Governmental stakeholders:

DNM

- Prefer to make policies from another perspective
- DNM pleaded for 20 % green within Oranjestad, but it became 7% or 9%. In the built with nature policy → now focussed any type of green or nature, not perse on trees or certain species
- Mentioned agreement with DOW to make a tree/green policy
- DNM likes to maintain and develop nature
- DNM prefers to work from broader nature goals. So if you would like to set up an area especially for the Choco (burrowing owl), it should contain elements a Choco needs. Same for the Dori (frog). After a plan for a goal is made, only then certain tree species can be chosen to fit that goal.
- They work from a bigger frame to eventually protect everything needed
- DNM tries to stimulate the society to care for nature. They want to bring back the balance between (economic) growth and nature.
- DNM pleads for numeric agreement in the ROP. This had not been successful yet.
- DNM would like to work with “Nature amenities” to promote nature also in other sectors.
    - For food
    - Microclimate
    - Habitats for animals
    - Social values
- Works from the ministry of transport, integration, nature and elderly causes (ministerie van transport, integratie, natuur en oudere zaken, TINO)
- DNM says a tree stock is something DOW should have. DNM however does record tree species for GIS data.
- DNM is busy lobbying for FPNA to get qualification to enforce laws

DIP

- DIP determines policy. Work conform the national ordinance spatial development. And national ordinance issuance properties (De landsverordening uitgifte eigendommen).
    - DOW is more civil engineering. They do building permits. Everything under the build ordinance.
- Getting a building permit goes through the DOW, but DIP determines land use. DIP is responsible for issuance of leasehold.

- In allotment plans DIP tries to spare areas with the most dense vegetation.
    - Because it is standard practise on Aruba to totally clear a lot for development. So when a lot is issued, nature is not save on it (usually).
- With the issuance of lots DIP now tries to keep building lots as small as possible for two reasons:
    - To be more efficient with space due to the overcrowding of Aruba. They want to enable everybody to have a property.
    - To protect nature and leaf more space for green. They try to make smaller lots with more space in-between. So the space between houses can stay green.
- This change shows the need for more knowledge.
    - Aruba needs building techniques that ensures coexistence of trees and buildings.
    - The need for education of civil servants
    - More knowledge on tree species and root systems (and how those root systems affect stability)
- They experience struggle. With the community but also internally. Due to lack of knowledge and priority differences (economy or nature).
- To determine nature value, DIP calls in DNM. They have the knowledge. Their advise is not legally binding but DIP tries their best to follow advises as close as possible.
- Minestry of general affairs, innovation, government organisation, infrastructure and spatial planning (Ministerie van algemene zaken, innovatie, overheidsorganisatie, infrastructuur en ruimtelijke ordening)

DOW

- DOW is responsible for park management (plantsoen beheer).
- Besides they are responsible for trees and shrubs alongside roads. They need to make sure branches aren't bothering or threatening traffic.
    - They confirm to have duty of care to make sure trees do not harm citizens or cause damage.
- Policy: work with a GIS platform to keep track on green zones that need maintenance, or are rated "well maintained".
- Policy: CROW. Criteria of all types of nature within the city (think of trees, bushes, weeds), and what they should look like. Every green zone gets rated and the rate determines if they are good as is, if they need maintenance or if they need major maintenance. Different areas have different quality requirements.
- They work with private contractors who are trained in working with CROW.
- CROW + the GIS platform have only be introduces by the end of last yes (about the end of November/December 2022).
- DOW does not have separate tree stock. They feel like this is more a DNM task.
- Selimar is also responsible for some areas and parks. They apply the same criteria.
    - How this works in practice is too new to judge. The first review moment has not been held yet.
- They have a department design and planning. This department is called in when new green zones/parks need to me created.
    - Preferably they plant out only native trees. In practise this doesn't always works
    - Seedlings come from DLVV or Fantastic Garden (store).

DLVV/Santa Rosa

- DLVV is the responsible authority for the flora (and insects) under the CITES convention. They are scientific and enforcing authority of CITES flora.
- They have done reforestation in the previous century, in Mira Lamar. Unfortunately this was not successful and not well documented.
- On agriculture: Interviewee has no specific direct knowledge on these plans
    - But generally he knows: end nineties the idea was to do less agriculture and more nature management, due to easy and cheap access to food through trade. Because of restrictions from Venezuela and the covid pandemic Aruba felt vulnerable due to less trade, therefor the idea to maybe start growing more food on the island came back.

Non-governmental stakeholders

FPNA

- FPNA ranger suffer from the lack of enforcement ability. Their moral lowers when they see people acting badly but not being able to stop it. Also their reputation suffers because people start to understand that they can do what they want. That rangers cannot punish them.
- FPNA wants to profile themselves as a conservation authority.
- They see a moral obligation to protect nature. For future generations. For the world.
- Protecting trees is a task you do for other. In one life time you cannot create a whole new forest, you do it for the next generation.
- To protect nature, is the reason for FPNA to exist.
- Nature management is about people management.
- Flora biodiversity enhancement programme: restore native vegetation and landscape. This project work on trees and shrubs.
- Vegetation mapping from unpublished papers in the nighties. → vegetation list created

Ban Lanta y Planta

- Non-profit organisation.
- Reforestation project on a 120 Ha piece of land in Noord. The piece of land is owned by a foundation.
- Goal to create a forest which can eventually sustain itself, so without watering or other actions from the foundation.
- Using native and neutralised trees.
- Now 2 tree nurseries, one in Paradera and one in Noord. This wills soon be only the one in Noord.
- Started during COVID-pandemic, in 2020.
- When they started they took on multiple project, now they focus on the 120 Ha piece of land.
- Only take outside projects if they meet BLyP standards:
    - BLyP has the capacity to run their own project and the outside project at that time
    - There is a water supply on the grounds of the project
    - The project area is fenced off (from cattle like goats)

StimAruba

- StimAruba in an association for people who want to address environmental issue. Since 1992
- They were active in education, gave courses, trained guides and gave excursions. They focused on nature but also culture. They also produced folders and magazines about nature

and areas on Aruba. They have good contact with other nature organizations and often are contacted to give advice.
- Everybody can become a member.
- They think they will convert to a foundation. Due to less interest.
- StimAruba is in favour of closing of areas for protection of trees because they have seen trees disappear from the wild through the years.

Other

Nature and Environment Policy Memorandum. DNM on task mentioned in the memorandum:

- Adjustment of nature protection regulation, NVB.
    - It is on the schedule → now busy with rights of nature
- Enact legislation regarding invasive and exotic species
    - is not done yet
- Action 3: Reforestation and planting of indigenous flora
    - does DNM not themselves. Mention that BLyP is doing great work
- Action 11: Monitor and research endangered species
    - DNM does research before writing advises
    - Also research from WUR and DCNA are mentioned

Built with nature interview 1:

- In het build with nature plan staat dat de deal was Samen met FPNA en DNM een groenbeleidsplan gaan ontwikkelen
    - Not executed because DOW does not cooperate anymore.
- Why lots of 750 square meters
    - According to interview 1: DIP decided that it should be lots of 750 square meters because in the past this was the standard size of lots. Unfortunately they do not work with this (big) size lots.
- Appendix B: replanting/compensation. In light green it said “Wildlife Garden Reserve”. Where does this take place.
    - It doesn’t yet. It is only an advise on how to replant/compensate in these areas. It did not happen (yet)
    - It is a concept to arrange a garden, park or area from the perspective that it can sustain wildlife.

Goats, interview 2:

- Goats still roam freely on Aruba, this is a problem
- On Aruba they are part of culture which makes it hard to take away this threat to trees.
- Cattle goats get released during daytime, to roam freely to feed on nature
- Management on Curacao is very successful

Greg Peterson, Aruban Birdlife Conservation

- Interview 2: mr. Peterson does a lot of advocacy and communication but this does not result in a larger following for the course. He seems to be preaching to his own choir, while educating unknowing people would make a change.
- Interview 3: Mentions Greg Peterson as a big influence on nature conservation. He initiated lawsuits regarding nature laws being broken.

- Interview 6: by approaching the court, ABC, educates the government in relevance of nature conservation. Their lawsuits enabled the designation of more nature reserves.

ROPV:

- Interview 6: maximum construction area of a lot is 60% or 70%, but there are no guidelines for the other 30% to 40%. So that doesn't protect trees on there because the can still be cut down.
- Natuur en landschap: No management takes place in these areas. DIP has authority but they are no management entity.