Widely resented yet neglected: latent environmental problems

The case of an invasive alien vine on Saba and Statia

JETSKE VAAS

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The case of an invasive alien vine on Saba and Statia

Ongemoeid doorgegroeid: latente milieuproblemen

De casus van een invasieve uitheemse klimplant op Saba en St. Eustatius

(met een samenvatting in het Nederlands)

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Jetske Vaas

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PROMOTOREN:

Prof. dr. P.P.J. Driessen
Prof. dr. M.J. Wassen

COPROMOTOREN:

Dr. F.S.J. van Laerhoven
Dr. M. Giezen

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Chapter 1

Introduction

1.1 INVASIVE ALIEN SPECIES IN THE CARIBBEAN NETHERLANDS: RESENTED YET NEGLECTED

This dissertation starts from a sense of wonder at the lack of action regarding a widely resented environmental problem. Inhabitants of Saba and St. Eustatius (commonly known as Statia) are vocal in their dissatisfaction with the invasive alien Coralita vine (*Antigonon leptopus* (Hook. & Arn.)), which originates from Mexico and has been spread all around the world, covering significant areas on the islands. It is infamous for covering vast areas rapidly, and for being very hard to remove due to tuberous roots that grow up to a few meters deep (Burke and diTommaso 2011). Coralita smothers native vegetation and overgrows nesting sites of iguanas, exacerbating the hardship of the endangered *Iguana delicatissima* (van der Burg et al. 2012). Coralita's presence on the islands was first officially recorded in 1902 (Boldingh 1909), and on Statia the plant is estimated to cover 15% to 20% of the island (van der Burg et al. 2012). These are predominantly former agricultural areas but also land on the borders of the national parks. On Saba, Coralita is creeping up Mount Scenery, which is crowned with a unique elfin forest and attracts many tourists (van de Kerkhof et al. 2014). Due to Coralita's pink flowers, it is a very visible phenomenon, and during fieldwork people frequently expressed their discontent regarding the vine covering such large areas and overgrowing their yards. Yet, this professed discontent is rarely accompanied by action to contain the vine. Which differs from the challenge regarding most invasive alien species, involving opposing stakes or a lack of awareness hampering action.

Species that are alien to an ecosystem and behave in an invasive manner have been deemed the second biggest threat to biodiversity, after habitat degradation (Pejchar and Mooney 2009). Next to that, they can incur great economic costs, by damaging agriculture, infrastructure and human health (Pimentel et al. 2005, Shine et al. 2010). Invasive alien species (IAS) are therefore tightly controlled in some countries, such as Australia and New Zealand (Koch et al. 2016) or Hawaii (Daehler et al. 2004), but the European Union only adopted the first regulation on invasive species in 2014 (European Parliament and Council of the European Union 2014). IAS can be globally appreciated (e.g., coffee, wheat or rice), the center of heated debate (grey squirrels in European urban parks), mostly ignored (summer lilacs in Europe) or commonly hated (Japanese knotweed in Europe) (Bertolino and Genovesi 2003, Koch et al. 2016). Management of IAS is not a straightforward endeavor, since large uncertainties are often involved, as well as many different stakes, and typically cooperation from a wide array of actors is required. Combined with the substantial potential damages incurred, IAS make for a significant governance challenge, and one that is increasingly receiving attention. This dissertation seeks to add to the governance literature on invasive alien species, by studying the lack of management and policy regarding an invasive alien species on two semi-sovereign Caribbean islands, Saba and St. Eustatius.

Islands are argued to be especially vulnerable to IAS, since their ecosystems are more fragile. That enhances both the chances of establishment of an alien and exacerbates its impacts (Kairo et al. 2003, Reaser et al. 2007). Although the exact dynamics remain disputed (Sax 2008, see Vilà et al. 2011), it is fair to say that there is a lot to be lost on Caribbean islands. They make up one of the world's 25 global biodiversity hotspots, with about 60% of the region's 12,000 plant species being endemic (Mittermeier et al. 1998, Kairo et al. 2003). This natural richness is an important attraction for the tourists who make up a significant part of the economy on many Caribbean islands. The already vulnerable agricultural sector on Caribbean islands is threatened by IAS as well. But despite the risks posed by invasive aliens and the assets to be protected, inertia in terms of policy and management exists on these two islands of the Caribbean Netherlands. Much research has been conducted (see Coblentz 1980, Jongman et al. 2010, Smith et al. 2014) and the expired Caribbean nature policy plan 2013–2017 mentions IAS as an important threat and encourages islands to develop policy (Ministerie van EZ 2013), but to no avail. With most land privately owned and an absence of spatial planning ordinances (Schoenmaeckers 2010), there is no view of any policy development soon either. And this policy inertia is compounded by a lack of management action on the part of private land owners, despite the general dismay Coralita is regarded with. Sabans and Statians are very aware and weary of the vine, and yet, there is policy and management inertia. This paradoxical concurrence of resentment yet neglect regarding an environmental issue, is the focus of this dissertation. Policy and management inertia are analyzed and strived to resolve, meanwhile eliciting defining characteristics of environmental problems such as Coralita on Saba and Statia. Thus, the dissertation offers insights useful for other cases of inertia as well.

1.2 GOVERNANCE CHALLENGE OF INVASIVE ALIEN SPECIES

The inertia this dissertation focuses on pertains to an invasive alien species (IAS). In this section the governance challenge posed by IAS is explored: what are IAS, and why are they so challenging to deal with?

1.2.1 What is an invasive alien species?

Many different terms exist: invasive, alien, exotic, non-native, introduced, pest – as diverse as the terms used for species that do not belong, is the contestation surrounding them. This dissertation uses the phrasing "invasive alien species", which comprises two elements: a "not from here" and a "causing disturbance" element.

Synonyms of the former are terms such as alien, foreign, exotic, non-native, and introduced, all implying a distinction between original and non-original elements of an

ecosystem. This leads some to argue that the field of invasion biology is rooted in xenophobia (e.g., Valéry et al. 2009, Davis et al. 2011). Indeed, when looking at the language used in invasive species literature, phrasings of aggressive invaders that show explosive growth and need to be combated are not uncommon: "(…) military metaphors and exaggerated claims of impending harm to help convey the message that introduced species are the enemies of man and nature." (Davis et al. 2011, 153). In response, others argue that such objections are unhelpful diversions of scientific attention, while invasions do pose a significant problem to biodiversity (Simberloff 2011). Whether xenophobic or not, a common view is that the spread of aliens started with either the Silk routes or Columbus traveling to the Americas (Leuven 2017). While for the European Netherlands a rather arbitrary date to distinguish between authentic and non-authentic species, for the Caribbean the arrival of Columbus indeed meant the start of major movements of organisms and goods. Apart from looking at whether a species was present in an ecosystem originally, one could focus on the role of humans in introductions. In the view of Richardson et al. (2000), a species is alien when its presence in an area is due to either intentional or accidental introduction through human activity. Leaving this debate as it is, following either definition, Coralita counts as an alien species on Saba and Statia.

The second part of the term "invasive alien" is highly normative, focusing on the damage an alien species can do to an ecosystem or area it is introduced into. Ecosystems are perceived as systems with a dynamic balance, meaning that they can adapt to changes within a certain bandwidth of resilience (Allen and Holling 2010). A species is invasive when it disturbs this balance and pushes the system beyond its limits, which can be assessed by the abundance or rate of spread of the species. This view has two implications, the first being that a native species may become invasive at some point as well, and linked to this, a debate on whether invasive species should be seen as the drivers of change, or the passengers of change (Bauer 2012, Grarock et al. 2014). When conceiving of invasion as a phenomenon caused by changes in the environment that allow it to proliferate (such as by Valéry et al. 2008), invasive species are passengers of change. Likewise, when looking at invasion as resulting from transportation into a novel environment, the vector of transportation is the real culprit. To dodge the need to disentangle such processes, one can also simply look at the impacts of the alien species once it has established, as will be addressed later. But does this mean that every species with negative impacts is an invasive species, and when does a native species that has negative impacts become an invasive species? On the Caribbean islands where this research takes place, Elephant ear (*Philodendron giganteum*) invades abandoned farmland and the understory of the native forest (van der Burg et al. 2012). Davis et al. (2011) argue that "Nativeness is not a sign of evolutionary fitness or of a species having positive effects.", pointing out that the most damaging insect in North America at the time was the native mountain pine beetle. Challenging this is research such as by Paolucci et al.

(2013) showing that introduced predators are more likely to coincide with decreasing prey populations than native predators. Richardson et al. (2000) keep it even simpler by deeming a plant invasive when it spreads more than 100 meters in less than 50 years if seed-dispersed, or more than 6 meters in 3 years for those spreading via roots. The definition of an invasive alien will likely remain contested for as long as it is the topic of research.

The foregoing discussion clearly shows that even among ecologists, invasive alien species spur much debate and little agreement. While attention for IAS for a long time remained confined to the field of ecology, it is nowadays recognized as inherently social as well (Shackleton, et al. 2019). For example, Richardson et al. state: "Humans cause invasions, humans perceive invasions, and humans must decide whether, when, where and how to manage invasions." (Richardson et al. 2008, 297). Put differently: there are no invasive species without humans. And as the next section will show, precisely this entanglement of the social and ecological dimension make for a complex governance challenge.

1.2.2 Why are invasive aliens a complex governance challenge?

While debates regarding IAS persist, the movement of species across the globe continues at an ever increasing rate. The spread of aliens surged during the industrial revolutions with railways, canals and highways, and the migration of 50 million Europeans to colonies abroad (Hulme 2009). But the real increase took place during the past 35 years, during what has been called the Anthropocene (Crutzen 2002) or Homogenocene (Samways (1999) in: Verbrugge 2014). Anthropocene refers to the current era in which planet Earth is dominated by humans, and Homogenocene refers specifically to the extinction of many species due to humans. Although there are too many unknowns to either corroborate or refute the claim that a "McDonaldization of ecosystems" will eventually occur (Lövei 1997), the potential damage of IAS is enormous (Pejchar and Mooney 2009). The latest United Nations IPBES report lists invasive aliens as one of the main drivers of degradation of natural life (Díaz et al. 2019). In that light, the increased invasion rate is very worrisome, and dealing with invasive alien species is an urgent but complex matter. Urgent, because tipping points can be exceeded, resulting in a regime shift and making it impossible to return to an earlier state (Gaertner et al. 2014). Complex, because the process, impacts and solutions of an invasion by an alien species are not easily understood and to a certain extent unknowable (Blackburn et al. 2011). Here three elements of the invasive alien species governance challenge are discussed: assessing the impacts, understanding people's perceptions, and getting people involved.

1.2.2.1 Assessment of effects: impacts and risks

As mentioned before, negative impacts are often central to the definition of what is and is not an IAS, for example in the framework presented by Marbuah et al. (2014), but also in the definition of the Convention on Biological Diversity: "Invasive alien species (IAS) are species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity." (UN 1992). Of course, whether impacts of a species are negative or positive can be source of contention (Blackburn et al. 2014, Woodford et al. 2016, Bacher et al. 2017, Zengeya et al. 2017). For example, exotic salmonids were introduced in many rivers in the Southern hemisphere, offering great sport fishing opportunities but endangering local fish species (De Leaniz et al. 2010). The *Acacia maernsii* tree, or black wattle, was introduced to South Africa in the mid-19th century and by now covers about 2.5 million hectares. While it is commercially valuable for timber, pulp and firewood, it has negative effects on water resources and biodiversity (De Wit et al. 2001). For these species, management measures are a source of great conflict, involving the weighing of positive and negative impacts (Novoa et al. 2016).

Often, establishing the effects of a given species is far from straightforward. One approach is to look at the ecosystem services no longer provided or the disservices delivered, due to an alien's establishment (Vaz et al. 2017). Methodologies based on this are for example EICAT (ecological impact classification of alien taxa (Blackburn et al. 2014)), SEICAT (socio-economic impact classification of alien taxa (Bacher et al. 2017)), and the Harmonia+ and Pandora+ protocol (D'hondt et al. 2014). The identified impacts can then be monetized (Born et al. 2005). Although monetizing impacts might work to raise awareness, it is also a very complex endeavor and results in conspicuous discrepancies such as a €12 billion a year estimate of damages for the EU versus €120 billion a year for the USA (Pimentel et al. 2005, Shine et al. 2010). These differences can be attributed to different accounting mechanisms, the inclusion of social costs, or whether preventive measures are accounted for (Bacher et al. 2017). Also, many objections have been raised to attaching financial value to nature, such as it being unethical, counterproductive, and unable to capture all values (e.g. Norgaard 2010, Spangenberg et al. 2015).

But for many species, the impacts on ecosystems are far from known, since what happens post-invasion is not a straightforward process: both the invading and the resident species will evolve in response to one another, which may affect abiotic processes in the system, in turn affecting the species, resulting in an infinite spiral of adjustments (Buckley 2017). These cascading effects are poorly understood, since metrics like impact-abundance relationships are not yet well understood (Sofaer et al. 2018). Given such profound uncertainties, IAS are often characterized as an environmental risk, for which risk analysis should be applied (Simberloff et al. 2005, Hulme 2006). This generally distinguishes between risk assessment and risk management, the former aiming to establish the risk of a species, i.e., the chance of it occurring and the impacts it would have. Risk

management looks at the risk that is acceptable, and as such involves a value judgement regarding the risk (Liu et al. 2011). Therefore, efforts have been made to enhance the role of stakeholders in risk analysis, following a wider trend within environmental sciences. For example, Liu et al. (2010, 2011) developed a Deliberative Multi-Criteria Analysis framework in which a jury is employed to weigh uncertainties, or to incorporate values and stakes in the decision-making. In a similar manner, Vanderhoeven et al. (2017) propose peer review and consensus building approaches, and increasing transparency regarding uncertainty in order to enhance risk assessments. Despite acknowledging the profound uncertainty involved with IAS, these approaches aim to prioritize species, sites, pathways and management approaches based on the quantification and valuation of risk. Uncertainties are assumed to pertain to the occurrence and effects of invasions, not to the valuation of invasions. For example, Liu et al. (2011) speak of epistemic and linguistic uncertainties, and of the need to incorporate different value judgements through participatory approaches. But the jury they propose to establish is supposed to assuage such uncertainties and ambiguities, and reach a decision in spite of it. One of the main arguments that will be put forward in this dissertation is that in some cases there is not so much a contestation over different valuations, but rather an absence of valuations due to latent problem perceptions. This will be addressed elaborately in chapter 3, and the next section relays the current understanding of how valuations of IAS come about.

1.2.2.2 An individual's perceptions

Quite some work has been done in the field of environmental psychology regarding IAS, exploring the way people perceive a given species and what determines their willingness to manage. The hierarchy postulated by Azjen's Theory of Planned Behavior (1988) presenting values and beliefs as the basis on which attitudes are produced, which subsequently determine behavior, is generally accepted. Concordantly, work to *understand* people's behavior regarding IAS has focused on their values and beliefs, whereas work to *influence* people's behavior typically focusses on their attitudes, assuming that the value and belief systems are too durable to be adjusted.

Regarding values and beliefs, a distinction can be made between held and assigned values. Held values are enduring and belong to the realm of world views (Slimak and Dietz 2006), value or attitude orientations (Sharp et al. 2011) and core beliefs (Sabatier 1988). Similar to beliefs, a held value "…reflects the most basic elements of cognition that facilitate preferences and induce action." (Van Riper and Kyle 2014, 375). Opposed to this, assigned values are perceived qualities of environmental resources based on benefits provided to people, and inherently unstable. They are more fluid than held values and directly influence behavior, while being influenced by the foundation of held values through which people interpret the world around them (Sharp et al. 2011, Van Riper and

Kyle 2014). The held beliefs have been found to be good indicators of support for environmental management. For example, environmental attitude orientations appeared indicative of support for invasive species management among visitors to Cumberland Island National Seashore in Georgia, USA (Sharp et al. 2011). Images of human-nature relations were found to be good predictors of support for non-native species management among the Dutch public (Verbrugge et al. 2013). In Ontario, Canada and Scotland, beliefs about invasive species regarding e.g., their impact and nativeness were found to be indicative of attitudes towards managing a species (Fischer et al. 2014). Several typologies with corresponding survey questions are used to investigate people's values, such as the New Environmental Paradigm by Dunlap et al. (2000), nature representations (Vanderhoeven et al. 2011), images of nature (Buijs et al. 2009), the Connectedness to Nature scale (Mayer and Frantz 2004) and the Images on Human-Nature relationships scale (de Groot 2012). As mentioned earlier, these values are typically understood not to be open to adjustments, but very influential. Conflicting value systems can result in contention between different stakeholder groups, and when communication about IAS and management efforts is not in line with extant value systems, it will not be accepted (Kalnicky et al. 2019). A "backfire effect" has even been reported, when messages challenge strongly held beliefs and result in even stronger support for misconceptions (Wald et al. 2019).

More dynamic are people's attitudes regarding IAS, which are affected by their knowledge and awareness of IAS, and their interaction with the species. Typically, the more direct the experience with an IAS and knowledge of how to control it, the more likely people are willing to control it (Shackleton and Shackleton 2016). But the opposite can happen too: when an IAS has a long presence in a community, people may have grown accustomed to them. Negative effects can become downplayed ("habituation effect"), or the species may have taken on an important role or service in the ecosystem (Kalnicky et al. 2019, Lewis et al. 2019). Lewis et al. (2019) argue that these should be taken into account, and thus decision-making should be based on two elements: people's attitudes regarding the species, and (dis)services delivered by the species in that given ecosystem.

Overall, understanding of people's perceptions regarding IAS is limited. See for example Shackleton and Shackleton (2017) or Heger et al. (2013) for attempts at assessing such perceptions, and the recent attempt at establishing a framework of factors affecting perceptions (Shackleton et al. 2019). This framework shows a wide array of factors involved, but gives little insight into their interaction, let alone their parametrization. Not understanding people's perceptions hampers their involvement in decision-making and management of a species, and can result in resistance (Sharp et al. 2011, Shackleton and Shackleton 2016). But even if a full understanding of people's perceptions could at some pointed be gleaned, then there are still some other factors at play before people will actually act and get involved with decision-making or policy development, which is the third element of the governance challenge IAS pose.

1.2.2.3 Stakeholder involvement in management

Let us assume for a moment that the impacts of an IAS have been established and people's perceptions are understood, resulting in the decision to manage the species. Note that it is increasingly acknowledged that in some cases an IAS is beyond eradication or resources are too limited, and an approach of "living with" can best be adopted (Head et al. 2015). But even when there are still options left, management is not a straightforward affair, and much more than simply deciding whether to eradicate, contain or suppress a species (e.g., Zimmerman et al. 2011). For example, risk assessments such as Harmonia$^+$ (D'hondt et al. 2014) or SEICAT (Bacher et al. 2017) are very elaborate, as is setting up proper pre-border control (Koch et al. 2016). And when looking at the IUCN "Guidelines for invasive species planning and management on islands" (2018), one finds that risk assessment and pre-border control are only a small part of the actions needed across ten thematic areas divided over three themes, ranging from building capacity, to monitoring changes, to post-management restoration. Moreover, management of IAS requires full cooperation of a wide array of actors, and as soon as one falters, the efforts of others can prove fruitless (Caplat and Coutts 2011).

Involving stakeholders with policy development and decision-making is increasingly recognized as crucial for the management of invasive alien species (IAS). Hulme (2006) calls public perception and stakeholder involvement "(…) arguably the most important yet most often overlooked (…)" aspect of IAS management (Hulme 2006, 845). Since then, involvement of stakeholders has received ample attention in literature, both arguing the why and how of involvement. The why is for example argued from a conflict resolution perspective: if people do not feel involved in decision-making regarding IAS management, they might refuse to cooperate at all (Crowley et al. 2017). Differences in valuation of IAS' impacts need to be accounted for in management decisions (García-Llorente et al. 2008, Shackleton et al. 2015). Next to affecting the management of IAS, humans also affect the occurrence of the problem itself. One, because people use and move organisms thereby mediating invasions, and two, because in the definition of invasiveness people's perceptions are key (Kueffer 2010).

An important challenge for stakeholder involvement is presented by the aforementioned divergent values, exacerbated by different interests, which results in opposing valuations of IAS and their impacts (e.g., Hulme 2006, García-Llorente et al. 2008). A large part of stakeholder involvement is thus to somehow match these different stakes. Next to that, social dynamics like trust, peer pressure and behavioral control beliefs mediate involvement. For example, Niemiec et al. (2016) draw attention to efficacy and behavioral control beliefs: do people believe they on their own or as a group can make a difference? Also important are social norms, such as peer pressure, mutual support and information sharing (Graham 2013). Social learning, good relationships and trust are therefore very important (Graham and Rogers 2017). Trust needs to be both horizontal – will my neigh-

bor deliver? – and vertical – will the government or nature manager deliver? (Marshall et al. 2016). To meet these needs, community-based polycentricity, co-management and co-design and partnerships for IAS management are called for (Marshall et al. 2016, Shackleton et al. 2019). Thus, from a stakeholder involvement perspective, the main challenges of IAS management lie with conflicting stakes and building social capital to allow for stakeholder involvement in decision-making and policy development.

1.2.2.4 Knowledge gap

The foregoing sketched the governance challenge of IAS as comprising three elements: the assessment of ambiguous and uncertain impacts, the different values and attitudes of people affecting that assessment, and the involvement of these people with decision-making and policy development. Much progress has been made in establishing the impacts of a species, while taking values and attitudes into account. Frameworks and methods abound for identifying stakeholders and involving them in decision-making, in order to improve management. For example, articles look at private landowners (Niemiec et al. 2016), urban garden owners (Shackleton and Shackleton 2016) or horticulturalists (Vanderhoeven et al. 2011) and how to get them to cooperate. But less researched, are cases of invasive alien species where there is no decision-making taking place; where there are no stakeholders, nor management efforts to involve them in. All the above-mentioned insights, e.g., into how to build trust, reach compromise and account for differences, were gained from situations where there was something happening. Either there were management plans but they required land owners' cooperation, or there were conflicts between actors with opposing stakes. But we lack understanding of cases where all this is largely absent, which is the knowledge gap this dissertation aims to fill. A case of an invasive alien species for which stakeholders are unknown, and policy and management are lacking, will be thoroughly analyzed and strived to resolve. In the following section, a research aim and question are formulated, after which the methodological approach is outlined for reaching that aim and answering that question.

1.3 RESEARCH STRATEGY

1.3.1 Research aim and question

From the review above, the intricacy of the governance challenge posed by invasive alien species becomes clear. Also sketched was the propensity of environmental governance literature to address cases where something is happening: there are stakeholders, management efforts or decision-making processes taking place that could be enhanced. Such articles start out by discussing the invasive species of interest, elaborating on its negative impacts and demonstrating why a currently uninvolved actor's cooperation

is crucial for successful management of the species. By analyzing what is at stake for that actor, the decision-making, policy development or management efforts regarding that species can be enhanced. This dissertation takes the opposite approach, by analyzing inertia pertaining to policy and management. Instead of asking how to enhance management activities, it asks why there are none; instead of identifying what is at stake for the local community, it explores a lack of stakes. By understanding a lack of policy and management action, insights are obtained into how to encourage action. Thus, the **research aim** of this dissertation is to:

Foster decision-making on invasive alien species, by understanding policy and management inertia

The inertia focused on pertains to the invasive alien Coralita vine (*Antigonon leptopus*) on the Dutch Caribbean islands of Saba and St. Eustatius. Despite its apparent rapid spread causing nuisance to every landowner and gardener, little to nothing is being done to manage the vine. European Union policies on invasive alien species do not apply on these islands, but the (expired) Caribbean nature policy plan 2013–2017 does identify IAS as an important threat and encourages the individual islands to develop policy (Ministerie van EZ 2013). This has not been done so far, and the reasons for this policy inertia will be researched in this dissertation.

However, Sullivan et al. (2017) show how oftentimes when *de jure* institutions are falling short, *de facto* institutions fill the gap for IAS management. In this case, the government and nature management organization are not fulfilling their formal role regarding the management of Coralita, but what about the community who has the plant growing on their land? Community action is an important element on both islands, given the large share of privately owned land (Schoenmaeckers 2010). Yet, despite the species being regarded a clear nuisance by almost every landowner, little management is undertaken by the community. The smothering vine poses a clear threat to agriculture, which given the peaking food prices in the wake of the 2017 hurricanes Irma and Maria and the increased push from the national government for increased self-sufficiency, is gaining importance (Ministerie van BZK 2018). These dynamics could have moved the community to act, but no *de facto* institution has picked up the gauntlet so far. This management inertia is researched as well, and avenues for lifting the policy and management inertia will be explored. The **research question** of this dissertation is thus:

How can the policy and management inertia regarding the invasive alien Coralita vine on Saba and St. Eustatius be explained and resolved?

Taking the opposite route – starting from what is not, in order to determine what is – is one of the elements that sets this dissertation apart and makes it valuable for environmental governance literature. Also, some methodological contributions are made in chapter 3 and 4, which can be of use to environmental issues beyond invasive alien species. Regarding invasive alien species literature, the dissertation contributes by broadening the scope from stakeholders to the wider governance arrangement. Stakeholder positions are analyzed, but additionally the governance configuration that mediates the development of policy, and the community's practices that mediate management activities are analyzed as well. From a societal perspective, the added value of this dissertation lies in addressing the highly challenging topic of invasive alien species, of which the importance has been elaborately discussed in section 1.2. But also in pointing at a specific set of environmental governance problems for which conventional decision-making approaches are not suitable, and offering alternatives. Let us now take a closer look at the case central to achieving these aims.

1.3.2 Case background: Saba and St. Eustatius

This dissertation focuses on two islands: Saba and St. Eustatius (commonly known as Statia), part of the Caribbean Netherlands (see Figure 1). *Saba* measures 13 km^2 and as such is the smallest of the two. It is the northernmost island of the volcanic inner arc of the Lesser Antilles and was formed about 500,000 years ago, making it younger than other islands in this region. The peak of the dormant volcano, surrounded by a few domes, rises out above the Caribbean sea to 872 meters. There is still a lot of geothermal activity, and because of the steep rocky coastline, erosion is an issue in many places. The slopes are steep, sometimes exceeding 60° or are even nearly vertical, making agriculture difficult. Although precise figures concerning Saba's economy are lacking, tourism is generally considered to be a major source of income and the main source of labor for its 2200 inhabitants, after the government and the medical university (van de Kerkhof et al. 2014, de Freitas et al. 2016, CBS 2018). *Statia* is located about 30 km southeast of Saba, has a population of 3300 people and is slightly larger: 21 km^2. It has a dormant volcano known as The Quill, which forms the highest point of the island at 600 meters. During the colonial period it accommodated about 70 plantations, mainly located on the flat areas in the center of the island. Currently, some agriculture still takes place, but the main economic activity is the oil terminal of the US company NuStar. Two other sources of employment are the local government and tourism (DLG 2011, de Freitas et al. 2012, van de Kerkhof et al. 2014, CBS 2018).

Although located closely to one another, the islands are rather different; both ecologically but also politically. Just like most islands in the Caribbean, they were held by many different colonial powers, until with the first Kingdom Charter of 1954, the islands Saba, St. Eustatius, St. Maarten, Bonaire, Curaçao and Aruba jointly formed the Netherlands

Antilles. In 1986, Aruba seceded, and after approximately 17 years of negotiations, referenda and protests, in 2010 the islands Saba, Bonaire and St. Eustatius became special municipalities of Holland, while St. Maarten and Curaçao became countries within the Kingdom, just like Aruba (Oostindie and Klinkers 2012). Bonaire, Saba and Statia form the Caribbean Netherlands, and are "public bodies according to article 134 of the Dutch Constitution" of the Netherlands (Spies et al. 2015).

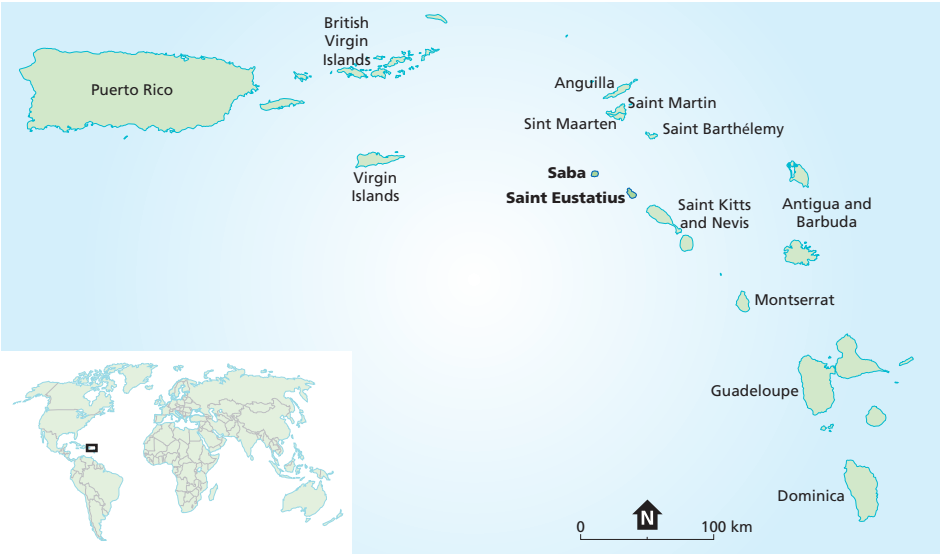

Figure 1. Map of the research locations: Saba and St. Eustatius

Although their structure is akin to that of Dutch municipalities, there are important deviations from Dutch law, for example regarding their tax system. Even though the islands are Dutch territory, deviation from Dutch law is allowed by article 1 sub 2 of the Statute of the Kingdom (Kingdom of the Netherlands 1954, Bröring et al. 2008). The original idea was to continue Antillean laws as much as possible, with new laws only for topics that had become the responsibility of the Netherlands, such as health care, education, and international security. Dutch regulation was then supposed to gradually replace Antillean legislation, but this intention appears to have withered. Instead, both sides have paid increasing attention to the specific contexts of the islands that require different laws and regulations (Spies et al. 2015). An anomaly in the configuration is the absence of the provincial tier of government, forcing ministries to directly communicate with municipal government. In theory, the RCN was supposed to serve as a linking pin between both entities, but island governments directly communicate with ministries and Rijkswaterstaat. Chapter 2 will look at the working of this in practice.

The relationships of the Netherlands with Saba and Statia respectively are quite different. Whereas Dutch officials visiting Saba always applaud its cooperative attitude, degree of organization and cooperation with The Hague (The Daily Herald 2018a, GIS Saba 2019), the Netherlands imposed supervision on Statia in 2015 (Van Kerkhof 2015a, Van Kerkhof 2015b), followed by complete overtaking of the government in February 2018 (Den Dool 2018). According to the Netherlands there was a situation of severe neglection of tasks, financial chaos, intimidation and lawlessness. Politicians on Statia openly voice their dismay about Dutch officials and even filed an injunction against the Dutch state. They claimed their right to self-government under the United Nations charter was breached by the Dutch interference, but the court disagreed (The Daily Herald 2018b). It seems likely that the Government Commissioner appointed by The Hague will stay on for at least full two years, and during that time no democratically-elected government is in place on Statia (FD 2019). Given these differences, the islands are addressed separately throughout this dissertation. Chapter 2 addresses Statia, chapter 4 Saba and for chapter 3 data was collected and analyzed separately per island.

Saba and Statia make for a highly suitable case to research an absence of action regarding an invasive species and how to deal with that absence. The small scale of both islands allows for a thorough analysis of the dynamics at play, and thus for gleaning a complete picture. Related themes and actors will quickly surface, and unexpected elements appear. Likewise, trying to make changes to dealings with Coralita might be more easily achievable on such a small scale. Lastly, the differences between the islands offer opportunities for making interesting comparisons, and enhance the external validity of the findings. Thus, despite this dissertation focusing on two small islands in the Caribbean, the findings are applicable to other invasive alien species that are not being dealt with. The next section outlines how the coming chapters contribute to that aim.

1.3.3 Outline of dissertation

This dissertation studies why there is policy and management inertia regarding Coralita, and how this could be resolved. The policy inertia is central to chapter 2, looking at the polycentric governance configuration of the islands and the European Netherlands. Chapter 3 focuses on the identification of stakeholders, despite the limited knowledge about the impacts of Coralita making it hard to articulate stakeholder positions. Chapter 4 looks at the lack of action on the part of the community, both explaining its absence and exploring how to encourage action. In chapter 3 and 4, the inertia regarding Coralita is explained by pointing at its latent problem status, as opposed to a manifest problem status. Chapter 5 seeks to corroborate that claim, by looking into the evolvement of problem statuses as well as the action and conflict occurring at each of them, concerning thirteen invasive alien species in the Netherlands. In chapter 6, the findings of the foregoing chapters are synthesized to answer the research question, and recom-

mendations given for further research. Chapter 7 offers a practice-oriented synthesis, by translating findings obtained during fieldwork and from the foregoing chapters, into hands-on recommendations for management of Coralita on Saba and Statia. Below in Figure 2, the contributions of each chapter to the analytical and action-oriented part of the research question are outlined.

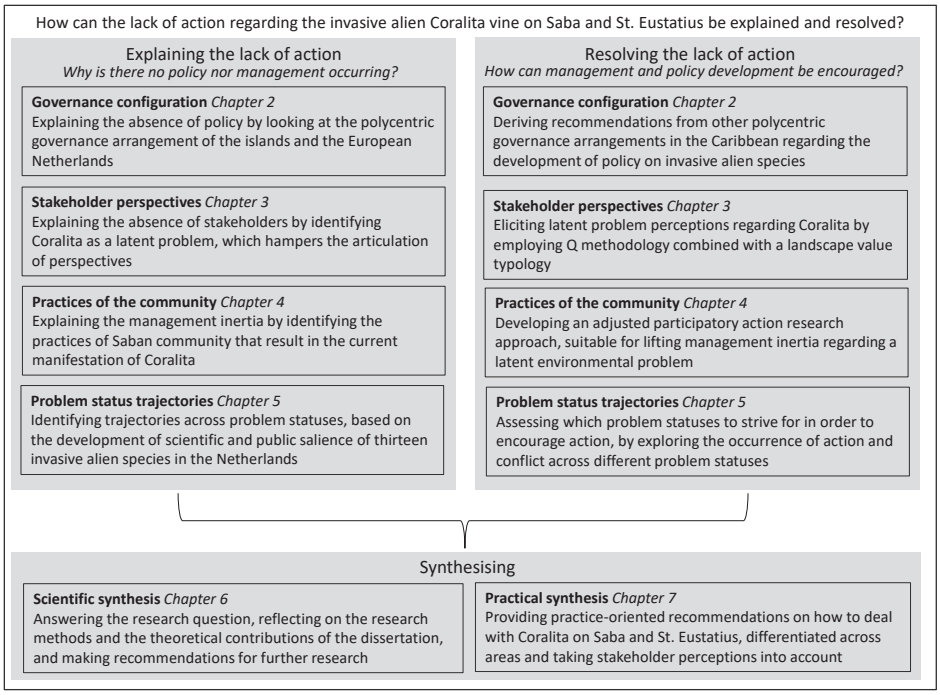

Figure 2. Set-up of the dissertation, with for each chapter indicated what its core contribution is.

1.3.4 Methodology

In this dissertation as well as per chapter, multiple methods were used to collect the data needed for answering the research questions. Mixed methods increase validity of research findings by triangulating data from different sources (Onwuegbuzie et al. 2011, Bryman 2016). Additionally, for some of the chapters methodological considerations are an output: in chapter 3, using Q methodology with a landscape value typology is proposed to elicit latent problem perceptions. In chapter 4, an adjusted version for participatory action research is developed and applied. An overview of the methods applied per chapter can be found in Table 1 below. The elements focused on listed in the far-left column coincide with elements outlined in Figure 2. More elaborate descriptions of the methods can be found in each of the chapters.

Analytical focus	Chapter				Method	Description of method
	2	3	4	5		
Governance configuration	■				Semi-structured interviews	Semi-structured interviews were conducted for chapter 2 and 4, in which you can find more details on selection of interviewees and questions asked. A semi-structured format worked best for both chapters since it strikes a balance between finding out what you want to know, and what you did not know you wanted to find out. For both chapters there was a framework with variables that needed to be addressed, but also a need for letting interviewees give their own experience of the topic (Galletta and Cross 2013). All questions were therefore open-ended, and respondents were asked for additional thoughts they would like to share (Magnusson and Marecek 2015). All interviews were audio-recorded and transcribed, and in chapter 4 NVivo was used for coding and analysis of the transcripts.
Daily practices of the community			■			
Governance configuration	■				Desk research	For every chapter the theoretical section is based on a more or less extensive literature study, into e.g. participatory governance, action research, or typologies of environmental problems based on the uncertainties involved. This served to gauge the theoretical and empirical data available regarding these topics. In chapter 2, 4, and 5 we did a more thorough content analysis of grey literature such as policy documents, scientific reports, newspaper articles, websites and videos. For chapter 2 and 4 this served as a foundation to build on with interviews, whereas in chapter 5 this is the sole source of information.
Daily practices of the community			■			
Problem status trajectories				■		
Stakeholder perspectives		■			Q methodology	Q methodology is combined with a landscape value typology in order to elicit latent problem perceptions, of which details can be found in the chapter.
Daily practices of the community Stakeholder perspectives			■		PPGIS	Public Participatory GIS was used to identify potential pilot areas, based on the presence of, and dislike for, Coralita. PPGIS is used to gather information on individual or community experiences of ecosystem services, to research ecological and social values in tandem, or to evaluate the compatibility of different projected uses of an area (Brown, Greg and Fagerholm 2015). In this dissertation it served to identify areas where people are most worried about Coralita, indicating pilot areas for chapter 4, and part of the management recommendations in chapter 7. Also, a mapping exercise regarding fences and the presence of Coralita was part of chapter 4.
Stakeholder perspectives			■		Online questionnaire	A small-scale questionnaire was administered on the perceived invincibility of Coralita among Sabans, of which the set-up and results can be found in the Appendix. It served to quantify the perceived invincibility of Coralita, and check if any changes were made by participating in the action research.
Daily practices of the community			■		Adjusted approach to PAR	An adjusted approach to participatory action research is designed and applied in chapter 4, aimed at being particularly suitable to lift inertia regarding latent environmental problems.

Table 1. Overview of the methods used in this dissertation, per topic of analysis and chapter

Chapter 2

Who's in charge here anyway? Polycentric governance configurations and the development of policy on invasive alien species in the semi-sovereign Caribbean

This chapter has been published as: Vaas, J., P. P. J. Driessen, M. Giezen, F. van Laerhoven, and M. J. Wassen. 2017. Who's in charge here anyway? Polycentric governance configurations and the development of policy on invasive alien species in the semisovereign Caribbean. *Ecology and Society* 22(4):1. DOI: 10.5751/ES-09487-220401

ABSTRACT

We address the development of policy by polycentric governance configurations, taking Caribbean overseas territories and their advancements on Invasive Alien Species (IAS) policy as an example. The French, British and Dutch islands in the Caribbean address this matter to different degrees, which we analyzed through differences in their type of polycentric governance configuration with their European counterpart. We employ a continuum ranging from predominantly polycentric to predominantly monocentric governance configurations to characterize the three case studies. Based on semi-structured interviews with government actors, park managers, and NGO employees on Guadeloupe, Anguilla, and St. Eustatius, plus a literature study, we characterize St. Eustatius as highly polycentric, and Guadeloupe as becoming increasingly polycentric. Anguilla cannot be considered either of the two, given virtually absent involvement of the UK. Policy development on IAS showed most progress in Guadeloupe, whereas in St. Eustatius and Anguilla IAS management is ad hoc. Within these cases, the hampering effect of contention about the functioning of the configuration showed clearly. For Guadeloupe, increasing autonomy to decide on policy priorities within a coherent system where standards are set and ample resources made available, appears conducive to policy development. That same balance inherent to polycentric systems between autonomy and coherence is hard to strike for St. Eustatius and currently mainly perceived as a trade-off, hampering policy development. By discussing these three cases, this study illustrates how different polycentric configurations can affect policy development.

2.1 INTRODUCTION

The Caribbean islands make up one of the world's 25 global biodiversity hotspots, with about 60% of the region's 12,000 plant species being endemic (Mittermeier et al. 1998, Kairo et al. 2003). Invasive species pose a major threat to biodiversity in island systems (Baillie et al. 2004). Although the entire Caribbean region is more or less equally vulnerable to invasions, and although the subsequent severe, negative impact of this phenomenon on important ecosystem services has been studied and acknowledged (see Kairo et al. 2003, Baillie et al. 2004, Shine et al. 2010, European Commission 2013), we observe that the problem is being addressed to very different degrees on different islands.

On Dutch islands, much research has been conducted on invasive alien species (IAS) such as Coral vine (*Antigonon leptopus*) (see Coblentz 1980, Jongman et al. 2010, Smith et al. 2014). This rapidly growing vine smothers native vegetation, threatening biodiversity which is a major tourist attraction, and overgrows nesting sites of the already threatened native *Iguana delicatissima* (van der Burg et al. 2012). On St. Eustatius the plant is estimated to cover 15-20% of the island (van der Burg et al. 2012). Yet not much policy has been developed to address the problems such species pose, other than a statement included in the Caribbean nature policy plan 2013–2017 about IAS being an important threat, and an encouragement addressed to the islands to develop policy (Ministerie van EZ 2013). By contrast, in the French Caribbean IUCN started working on the topic in 2005 and on the British islands there have been several initiatives, such as the creation of a plant pest identification service, projects on the invasive lion fish and workshops on non-native species (DEAL Guadeloupe and DEAL Martinique 2013, JNCC 2015). A conspicuous characteristic of these islands is their constitutional link with a European country, through which they have accrued configurations spanning multiple decision-making centers. We speak of governance configurations since NGOs like IUCN or Anguilla National Trust play an important role. The extent to which these configurations "(…) actually function independently or instead constitute an interdependent system of relations (…)" (Ostrom, Tiebout and Warren, as cited in Ostrom 1972, as cited in McGinnis 1999) differs between the islands, which we approach as different types of polycentric configurations. Whereas Guadeloupe is a *region* and *département* (county) of France and like every other county subject to French law, Anguilla shares little with the United Kingdom besides British citizenship. The Dutch island St. Eustatius is transitioning towards tighter nestedness into Dutch legislature, while at the same time striving for more leeway in decision-making.

In this chapter we use those Caribbean case studies to illustrate how different types of polycentric governance configurations influence the development of policy on IAS. The research question we address in this chapter is: how does the type of polycentric

configuration of a Caribbean overseas territory and its metropolis influence the development of policy regarding invasive alien species?

2.2 CARIBBEAN TERRITORIES AS POLYCENTRIC CONFIGURATIONS

The overseas territories in the Caribbean region are sometimes perceived as anomalies, symptoms of incomplete decolonization, but the benefits of maintaining ties with a metropolis are increasingly recognized (Baldacchino 2006, Oostindie 2006). In terms of per capita income; the functioning of a representative democracy and guarantees of civil rights and liberties; and with regard to migration, non-sovereign territories in the Caribbean generally outperform sovereign states such as the Dominican Republic and Haiti (Baldacchino 2006, Oostindie 2006). Literature on small island states or sub-national island jurisdictions recognizes the potential benefits of ties to a larger state, even if that implies asymmetrical power relations (e.g. McElroy and Pearce 2006, Veenendaal 2014). However, for those configurations to truly work, they need to have come about in settings of genuine mutual consent (Baldacchino and Milne 2006), and certain areas such as finances and natural resources might be better left with the islands (Baldacchino 2006). Thus, a balance needs to be struck between autonomy of the island and integration with the metropolis. This calls to mind governance literature on polycentric arrangements, where multiple decision-making entities are linked under an overarching system of rules, while retaining relatively autonomous prerogatives (Ostro 1972, as cited in McGiddins 1999). According to Marshall (2015) *de facto* autonomy is required for polycentricity, since *de jure* arrangements can play out like monocentric arrangements in reality (and the other way around). Polycentricity is seen to render governance arrangements adaptive and robust (Folke et al. 2005, Pahl-Wostl and Knieper 2014, Marshall et al. 2016), motivating voluntary cooperation (Marshall 2009) and to potentially outperform larger centrally controlled arrangements (Ostrom et al. 1961, Andersson and Ostrom 2008). However, just as there are many different island-metropolis configurations, there are different kinds of polycentricity, depending on the degree of autonomy of the decision-making centers (Gruby and Basurto 2013). We employ three Caribbean overseas territories and their development of policy on invasive plant species to learn more about the influence of different kinds of polycentricity on policy development.

Let us first take a closer look at polycentricity, which originally aimed at explaining the success of science. In science, an abstract end-goal (objective truth) is pursued by actors that are free to contribute however they like, rather than their contributions being managed by a single entity in which power is vested (Polanyi 1951). Vincent and Elinor Ostrom applied polycentric thinking to the study of metropolitan areas, when it was generally accepted that the fragmentation of authority and overlapping jurisdictions

constituted chaos and led to failure. They found that a fully monocentric system is not necessarily more efficient than a polycentric one (Ostrom 1972, as cited in McGinnis 1999). Polycentric systems consist of formally independent centers, yet there is an overarching system into which all local units are nested to some extent, defined by Gruby and Carlisle (2015) as "acting in ways that take each other into account". This allows polycentric systems to reach a common goal (Ostrom 1972, as cited in McGinnis 1999, Aligica and Tarko 2012). Important to note is that the distinction between a mono- and polycentric system is not a binary one; systems are *predominantly* mono- or polycentric, but can still have elements of the other type (Ostrom 1972, as cited in McGinnis 1999). The Caribbean overseas territories hold different degrees of autonomy and integration regarding the metropolis, so can be placed on different spots along the polycentricity continuum. How are their dealings with the same problem, namely invasive alien species, affected by that?

2.3 METHODS

2.3.1 Case selection

By exhibiting different degrees of polycentrism in their governance configurations with the metropolis, the Caribbean overseas territories of France, the Netherlands and the United Kingdom make for interesting cases to compare. In this section we elaborate on the conspicuous aspects of their respective configurations and the selected field work sites.

The French islands of Martinique and Guadeloupe appear to be tightly integrated into the French state. Since 1946 they have held the status of *départements et régions d'outremer* and they are Ultra-Peripheral Regions (UPRs), to which all EU law in principle applies (Oostindie 2006). The French have actively lobbied for the right to retain tight links with their overseas territories within the EU structure (Blanchard et al. 2013), and often speak of them with pride (Hintjens and Hodge 2012). Rather different is the continuously contested and loose link of the Netherlands with Bonaire, Saba, and St. Eustatius. The original kingdom configuration of 1954 was modified in 1986 and again in 2010 after 17 years of negotiation and plebiscites (Oostindie and Klinkers 2012). The islands are Overseas Countries and Territories (OCTs), hence only a limited fraction of EU law applies. Despite being (special) municipalities of the Netherlands, they have a very different tax system and are not part of the EU common market (Adeler and Kavelaars 2011, Murray 2012). The British Caribbean overseas territories of Anguilla, Montserrat, Turks and Caicos islands (TCI), British Virgin islands, and Cayman islands are highly autonomous. The UK does not structurally contribute financially to the islands, even though the UK is the ultimate responsible actor under the concept of "contingent liabilities" (Clegg 2006,

Hintjens and Hodge 2012). Through these different degrees of polycentrism combined with aforementioned differences in IAS policy development, the cases offer insightful comparisons.

We conducted fieldwork on one French island (Guadeloupe), one British island (Anguilla), and one Dutch island (St. Eustatius). Guadeloupe, with a population of 468,000 and territory of 1705 km^2 (UNdata 2015), is relatively large for the Lesser Antillean islands. Anguilla is a British overseas territory that in terms of GDP is comparable to the other two islands, whereas other British territories nearby have a very distinct financial service economy. It has a population of 14,000 and area of 91 km^2 (UNdata 2015). St. Eustatius, with a population of 4020 in 2012 and area of 21 km^2, is the smallest (CBS 2013). Other, possibly confounding, factors are relatively stable. France, the UK, and the Netherlands are all European countries that obtained control over the islands in the Caribbean during the colonial era and are still linked to them. The fact that they are Western European countries also makes their political and socio-economic context similar. Next to that, the islands have to abide (be it to varying degrees) to the same body of European law. By focusing on Caribbean territories and not, for example, on French territories in the Pacific Ocean, we have attempted to ensure that the islands studied have a similar cultural background. Thus, despite the different sizes of these islands, we believe the factors they have in common will allow us to derive useful insights from a comparison on policy advancements.

2.3.2 Operationalization of variables

We approach the cases as embodiments of different polycentric governance configurations, manifesting different degrees of policy development regarding invasive alien species. For the latter we employ the policy cycle as outlined by William Dunn (1994): agenda-setting, policy formulation, policy adoption, policy implementation and policy assessment. Implementation of policy entails one of the formulated policies being carried out by administrative units which mobilize resources to that end. Determining whether these policies are indeed being abided by is policy assessment. Per case we will indicate the progress made across these phases.

To characterize the polycentric governance configuration, we first look at Vincent Ostrom (1972, as cited in McGinnis 1999), reflecting on the article he published with Tiebout and Warren ten years earlier (Ostrom et al. 1961). They had defined polycentric systems as consisting of multiple decision-making entities, with shared and possibly overlapping mandates and none having the ultimate decision-making power. In the 1962 reflection he contends that "…a general system of rules as providing a framework for ordering relationships in a polycentric system is an issue that was seriously neglected in Ostrom, Tiebout and Warren" (Ostrom 1972, as cited in McGinnis 1999, 58). Aligica and Tarko (2012) discuss the same three variables, defining polycentric systems as "(…)

many decision centers having limited and autonomous prerogatives and operating under an overarching set of rules" (ibid.: 237). A visualization of this framework was presented by Gruby and Carlisle (2015) at the IASC meeting of May 27th, 2015, showing three variables: multiplicity of centers for decision-making, overarching system of rules, and spontaneous order by evolutionary competition. Pahl-Wostl and Knieper (2014) mention two variables: multiple centers of decision-making and an overarching system of rules. Marshall (2015) looks at *de facto* autonomy "(…) the entities exhibit considerable or substantive de facto autonomy from each other." (Marshall 2015, 14). In addition, he mentions coherence by the centers entering into competitive, cooperative and conflict-resolving relationships as the distinguishing feature between a polycentric arrangement and system. This seems to capture both an overarching system of rules and spontaneous order, hence we will look into two variables: autonomous decision-making centers and coherence. An overview of how we operationalize these two variables is shown in Table 2.

Sub-variable	Indicators	Source
Autonomous decision-making centers		
	Multiple autonomous decision-making entities actively devise and enforce rules, norms and strategies	Gruby and Carlisle 2015
	Opinions are implemented in practice by the decision-making centers	Aligica and Tarko 2012, 254
	The entities have a general understanding of the jurisdiction or domain of authority of one another	Gruby and Carlisle 2015
	The decision centers have shared or common goals	Aligica and Tarko 2012, 254; Gruby and Carlisle 2015
Coherence		
Overarching system of rules	The overarching system of rules complies with the decision centers' needs	Aligica and Tarko 2012, 254
	The decision-making centers actively coordinate with one another and exchange knowledge	Aligica and Tarko 2012, 254; Gruby and Carlisle 2015
Stability	Frequency of changes to, duration of decision-making process regarding, constitutional configuration	Oostindie & Klinkers 2012; Veenendaal 2014
	Contention surrounding the constitutional configuration	Oostindie & Klinkers 2012; Veenendaal 2014
Tightness	Resource interdependencies: is the dependence one-way or mutual?	Oostindie 2006, McElroy and Parry 2012
	Geopolitical status island: legal status within EU and metropolis; citizenship; part of EU customs zone	Oostindie 2006

Table 2. Overview of the sub-variables and their indicators of the polycentric governance configurations

There are *autonomous decision-making centers* actively expressing and acting on their opinions. Yet, they are aware of the other centers' jurisdictions, and have a shared goal (Aligica and Tarko 2012, Gruby and Carlisle 2015). In our cases, institutions and actors on the islands but also in the metropolis are the decision-making centers. *Coherence* is the extent to which decision-making centers take each other into account when making decisions, and whether they engage in competitive, coordinating and cooperating relationships (Ostrom 1972, as cited in McGinnis 1999, Pahl-Wostl and Knieper 2014, Marshall 2015). It stems from an *overarching system of rules* that needs to fit the decision-making centers' needs, and to which all centers contribute (Aligica and Tarko 2012, Gruby and Carlisle 2015). For our study, the arrangement that links the metropolis and island is the overarching system constraining the decision-making centers' governance. *De jure*, this system exists given the islands' overseas territory status, but our concern here is with *de facto* coherence. In the literature on sub-national island jurisdictions multiple factors mediating the coherence between a territory and metropolis are mentioned, which we group together under *stability* and *tightness*. Regarding *stability*, we look at the continuity of the constitutional configuration, which comprises both the changes made through time and the contentions accompanying these changes (Oostindie and Klinkers 2012, Veenendaal 2014). Regarding *tightness*, dependency of the metropolis and the islands can for certain resources be one-way or mutual (Baldacchino and Milne 2006). In addition, the geopolitical status of the island is important, comprising the island's legal status within the EU and the nation state; for example, UPR status within the EU means much stronger nestedness than OCT status (Bröring et al. 2008), and the influence of CARICOM (Caribbean Community and Common Market) on the islands defines their insularity.

For each of the cases we discuss the materialization of these variables, as well as indications given in the interviews of how they influence policy development. In order to assign each case to a spot on the polycentricity continuum, we focus on the degree of autonomy of the decision-making centers, in line with Gruby and Basurto (2013): "More polycentric systems will show significant autonomy for decision-making among local units and units operating over larger jurisdictions. In less polycentric systems, for example, nested enterprises may engender partial or complete dominance of local groups by government regulators or other powerful actors (…)" (Gruby and Basurto 2013, 262). Hence, on the polycentric end of the continuum (see Figure 3) we place the cases with high autonomy within the overarching system, and on the monocentric end the cases with low autonomy within the overarching system. Combined with the earlier mentioned gauged differences in policies on IAS, we tentatively place the French islands in quadrant 2, the British in quadrant 1, and the Dutch in quadrant 4 of Figure 3. How we gather the data to verify that, is explained in the next section.

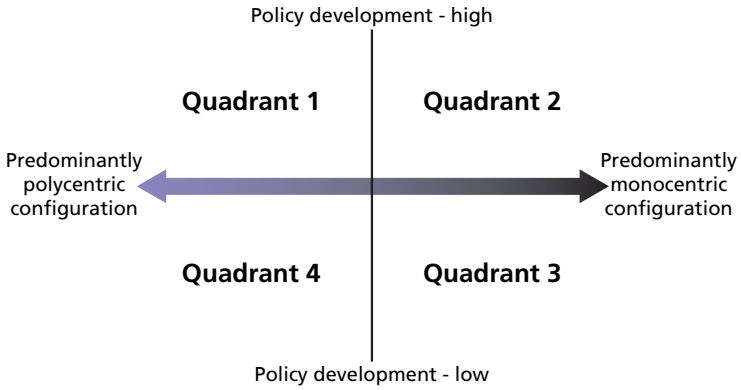

Figure 3. Quadrants in which different polycentric governance configurations can be placed. The horizontal axis depicts the contrast between different configurations. On the vertical axis, the contrast between limited and advanced policy development is depicted.

2.3.3 Data collection and analysis

Our study of the scholarly and secondary literature that focused on the three cases both informed the analytical framework presented earlier (Table 2) and provided a basis for the interview questions. Since the research site was new to us and the topics we wished to address broad-ranging, we conducted semi-structured interviews. Hence, we could adjust the questions throughout the interview, depending on the interviewees' expertise, and follow up on insights that emerged during the interview. As such, we paid attention to "…lived experience while also addressing theoretically driven variables of interest." (Galletta and Cross 2013, 24). This also implies that we mostly formulated open-ended questions, in order to "…elicit rich, full, and complex accounts from participants." (Magnusson and Marecek 2015: 47).

Preliminary findings on the governance configuration gleaned from scientific and grey literature were validated through the interviews, and remaining gaps in understanding were filled. The interviews were conducted in October and November 2015 with government actors, park rangers, and NGO employees, all of whom were to some degree involved in IAS management. Interviews were conducted in English, French, or Dutch, and because the populations of the islands are small, the interviewees' anonymity has been respected in this. We interviewed four people on each island. On Bonaire we interviewed a representative of the Caribbean Netherlands Kingdom Services and one of the Dutch Caribbean Nature Alliance: two institutions whose jurisdictions also cover St. Eustatius. We also interviewed two government officials in the Netherlands and France, to get the perspective of the metropolis. Thus in total there were 16 interviews (see Table 24 in the Appendix). The number of interviewees is not very high, but given the small scale of the islands, we believe the interviews to be representative. Table 25 in the Appendix lists per indicator the interviews in which it was addressed. In the next section the sub-variables

are analyzed in a narrating manner. We discuss the responses per variable as well as links with the advancements of IAS policy mentioned in the interview. Based on the *autonomy* variable and the *advancement of IAS policy*, we place the cases in Figure 3.

2.4 RESULTS

In this section we present the findings from our research, first in terms of the advancements in policy development across the three cases and subsequently in terms of their polycentric configurations.

2.4.1 Policy advancements on IAS

The combination of desk research and semi-structured interviews did indeed reveal differences in the degree to which policy on IAS has been developed. Remarkably, in all three cases IAS activities can be located across multiple phases of the policy process, indicating a rather messy and non-linear process, as shown in Table 3. Anguilla does not have policy in place, since a general framework for IAS management was provided by the National Environmental Management Strategy and Action Plan, but that expired in 2010. A draft IAS strategy does exist, but it has never been endorsed by the government. The Department of Environment is nevertheless implementing parts of it, mostly those relating to education and awareness raising (Interviewee 11). They are also haphazardly attempting to contain certain species: the departments of Environment and Agriculture communicate on this and sometimes disagree, but this has never resulted in a structured program (Interviewees 11 and 12). Thus, Anguilla undertakes some IAS management activities, but not according to an endorsed strategy or policy.

After five years of contention about the division of mandates and responsibilities, Guadeloupe has begun designing multiple management tools for IAS. These will be embedded in the Regional Scheme in the making. Local government has set up working groups with stakeholders and a scientific council, so support is being acquired from the target groups of present and future policy. Also, the relevant authorities coordinate their approaches (Interviewees 3 and 4). Guadeloupe has overall proceeded to the phase of policy implementation.

Lastly, St. Eustatius has no IAS policy plans, despite the very visible spread of Coral vine (Smith et al. 2014). They have asked the Netherlands for help in developing their own nature policy plan, which is still forthcoming (Interviewee 14). The park management organization STENAPA tries to control it in the parks and their botanical garden, but in other public areas no one is really responsible and there is no IAS strategy (Interviewee 6). Interestingly, Anguilla is more active regarding IAS than St. Eustatius, even though the latter has a much higher GDP (USD 26,300 per capita in 2012 versus USD 12,200 in

2008), and receives structural financial support from the Netherlands whereas Anguilla does not (CIA World Factbook 2015, SCP 2015).

Summing up: Guadeloupe is advanced in developing IAS policy, but Anguilla and St. Eustatius are not. Despite the lack of policy in place, Anguilla's government is incidentally managing species throughout its territory, whereas St. Eustatius does so only in the national parks. We will now turn to their respective governance configurations, to see what differences exist there.

Territory	Guadeloupe	Anguilla	St. Eustatius
Agenda-setting			
	IAS have been on the agenda of NGOs, the ministry and the local government for approximately 5 years (Interviewees 1, 3, 4)	Awareness of IAS is present among the population and the government (Interviewee 11)	IAS are a well-known phenomenon, though perception of the problem differs (Interviewees 6, 7, 8, 13)
	The ministry is conducting studies on the economic impacts of IAS (Interviewee 1)		Government stresses the need for insight into the economic impacts of the plants in order to create willingness for management (Interviewees 7, 8)
	IAS is listed in National Biodiversity Strategy as a topic that should be addressed by Guadeloupe (DEAL Guadeloupe and DEAL Martinique 2013)		The BES Nature policy plan lists IAS as a problem, and orders the islands to come up with policies to address them, but this has not yet been done. (Ministerie van Economische Zaken 2013)
Policy formulation			
	In the first years of awareness of the problem there was much debate about who should deal with the issue. Only recently has local government taken on the responsibility (Interviewee 1)	Draft strategy of IAS management has been developed by local department of environment, but not yet endorsed by rest of the local government (Interviewee 11a)	Project proposal for Dutch funding was written by the park management organization to deal with IAS, but island government refrained from submitting it (Interviewee 6)
	NGOs and universities are closely involved with the design of policy (Interviewee 1)	Most land is privately owned and proposed laws impinging on private land lead to much public protest (Interviewees 9, 11, 12a)	Many reports written with elaborate recommendations, but not many of them have been adopted nor implemented (Interviewee 9)

Territory	Guadeloupe	Anguilla	St. Eustatius
	A Regional Scheme for Natural Patrimony and Biodiversity is being developed by the local government and will include IAS policies (Interviewee 3)	Government actors frequently participate in workshops and conferences on this topic (Interviewee 11)	
	Working groups with local stakeholders are elaborating the biodiversity strategy (Interviewee 3)	National Environmental Management Strategy and Action plan speaks in very general terms about IAS management, and expired 6 years ago (Government of Anguilla 2005)	
	A scientific committee appointed by the ministry is drafting a list of native and invasive species (Interviewees 1, 4)		
	A procedure for managing and controlling IAS has been drafted by the local office of the ministry, but has not yet been endorsed by other actors (Interviewee 1)		
Policy adoption			
	Ministry and local government have agreed that projects on invasive species will be prioritized when allocating project funds (Interviewee 1)	IAS are mentioned in National Biodiversity Strategy and Action plan. Local government says they abide by it, but difficult to get a copy (Interviewees 9, 11)	Many reports written with elaborate recommendations, but not many of them have been adopted nor implemented (Interviewee 9)
		For some IAS the departments of Agriculture and Environment do not agree about the required actions (Interviewee 11)	
		The numerous laws on nature and environment are scarcely being implemented by local government (Interviewee 9)	

Territory	Guadeloupe	Anguilla	St. Eustatius
		There is no structured program in place for management of IAS, nor is there a strategy for dealing with encountered IAS (Interviewees 9, 11)	
Policy implementation			
	Local government is funding projects on lion fish and green iguana (Interviewee 3)	Giant African snail has been brought under control through involvement of population (Interviewee 11)	Management of nature is limited to the NGO mandated to manage the parks (Interviewees 7, 13)
	National park is running pilots on bamboo eradication (Interviewee 4)	Brown rat on a smaller uninhabited island has been exterminated (Interviewee 9)	Nature laws designed by the Netherlands are scarcely being implemented (Interviewee 13)
	Ministry is funding pilot on lion fish (Interviewee 1)	Lion fish has been made into a delicacy and has even become scarce (Interviewee 11)	Coral vine is removed sporadically from the botanical garden (Interviewee 7)
	Most attention for IAS is in relation to health issues and pest control (Interviewee 1)	In general, invasive animals receive more attention than plants (Interviewee 11)	
	About €6 million project funding is available for the coming 7 years for biodiversity. The application process has started (Interviewee 1)	Awareness raising and environmental education campaigns announced in draft strategy of IAS management are in place (Interviewee 11)	
		Coordination between the departments of Agriculture and Environment on the removal of specific species takes place (Interviewees 11, 12)	
Policy assessment			
	Guadeloupe has a good environmental police force able to enforce regulations (Interviewee 1)	Enforcement of law is difficult, and is, e.g., clearly non-existent regarding turtle hunting (Interviewee 9)	Several instances of spatial planning documents being breached by the local government (Interviewees 6, 13)
			Existing laws on roaming animals are only incidentally implemented by local government (Interviewee 13)
Policy developed?	Partly, and well on track	Haphazard activities	Haphazard activities, only in the parks

Table 3. Findings regarding policy development on IAS in the three cases

2.4.2 The Caribbean polycentric configurations

Having established differences in the development of policy regarding IAS, we describe per island the polycentric governance configurations, drawing on the interviews and desk study.

2.4.2.1 Caribbean Netherlands

In 2010, Bonaire, St. Eustatius, and Saba moved from being entities within the federal system of the Netherlands Antilles to "public bodies according to article 134 of the Dutch Constitution" of the Netherlands (Spies et al. 2015). Although their structure is akin to that of Dutch municipalities, there are important deviations from Dutch law, for example regarding their tax system. Even though the islands are Dutch territory, deviation from Dutch law is allowed by article 1 sub 2 of the Statute of the Kingdom (Kingdom of the Netherlands 1954, Bröring et al. 2008, 150). The original idea was to continue Antillean laws as much as possible, with new laws only for topics that had become the responsibility of the Netherlands, such as health care, education, and international security. Dutch regulation was then supposed to gradually replace Antillean legislation, but this intention appears to have withered. Instead, both sides have paid increasing attention to the specific contexts of the islands that require different laws and regulations (Spies et al. 2015). For nature management the *overarching system,* i.e., the Netherlands, is responsible for compliance with international commitments, but the islands need to manage nature on their own territory (Interviewee 14). However, due to limited resources, St. Eustatius often argues it needs help from the Netherlands for taking on that responsibility (Interviewees 6, 13, 14). There seems to be some confusion about what are local responsibilities, and what the rather lean *overarching system* is supposed to do.

Though this might change, currently the *local decision-making centers* are quite independent from one another. Since the islands are now municipalities of the Netherlands, there are national responsibilities residing with the Netherlands (overlapping jurisdictions), and municipal responsibilities residing with the respective islands (parallel jurisdictions) (Bröring et al. 2008). When it comes to invasive species, no common goal exists since that should be defined on island-level. More generally, the mutual awareness of St. Eustatius and the Netherlands is high due to the lengthy constitutional debates, but understanding is sometimes lacking (Interviewees 7, 8, 13, 14, 15). Due to the difficult communication with ministries in the Netherlands, the exercising of the island's opinions by implementing them into practice is quite limited (Interviewees 5, 8, 13). The supervision imposed by the Netherlands epitomizes this (Van Kerkhof 2015a, Van Kerkhof 2015b). The concomitant limitations on spending by the government were mentioned as hampering the development of nature policies (Interviewees 6, 7, 8, 14). In general, the island desires greater autonomy in deciding what to spend their money

on (Interviewees 6, 8) and a bigger mandate (Interviewees 6, 8, 13). As it stands, their degree of autonomy is moderate.

The delicate relation between the Netherlands and St. Eustatius makes their coherence much debated. As several interviewees indicated, it is difficult for such a small island to attain to the same standards of governance as the Netherlands (Interviewees 5, 7, 8, 13, 15). This is seen both as a problem of capacity (Interviewees 7, 8, 13) and as the outcome of different standards (Interviewees 13, 15). Contributing to that challenge is the absence of the provincial tier of government, since that makes it necessary for Dutch ministries to communicate directly with the islands, which is something they are neither used to nor good at (Interviewees 8, 13, 14, 15). Also, the checks and balances that provinces exert, are missing and the ministries are reluctant to interfere in disputes at island level (Interviewees 13, 14, 15). Yet, because of their "special municipality" status, the islands have high expectations regarding the improvement of their facilities (Spies et al. 2015, Interviewees 7, 8, 13). Currently, the level of socio-economic development on the islands is recognized by the Netherlands as being too low, but not necessarily to be leveled with that of the Netherlands (Interviewee 15). Thus the islands' special municipality status leads to some confusion. However, financial investment has increased greatly: the budget spent on these three islands increased from €113 million in 2010 to €310 million in 2015 (Spies et al. 2015, 123). About 80% of that comes from the ministries and is earmarked for a specific purpose, which is found to make the relation between the local government and the Netherlands skewed (Spies et al. 2015, Interviewee 8). The mutual dependency is very lopsided, as can be seen from the budget and as agreed by the interviewees (Interviewees 5, 6, 8, 13). Insularity is high and the influence of Europe is minimal; the islands have remained OCTs and the plan to make them into UPRs seems to have waned (Interviewee 15). They can apply for project funding from the EU through the BEST grants and an innovation program for OCTs, but that's the only influence mentioned by the interviewees (Interviewees 5, 6, 13, 14). Overall, the link between the Netherlands and St. Eustatius can be characterized as tight but asymmetric. The island is very dependent on the Netherlands (Interviewee 5, 8, 13), but feels that the Netherlands is carefully strategizing its involvement and only supporting them as municipality when it is convenient to do so (Interviewees 8 and 13). The bond is not very stable: the original configuration of 1954 was modified in 1986 and again in 2010 after 17 years of negotiation and plebiscites, and two decades fraught with protests and campaigns (Oostindie and Klinkers 2012). In St. Eustatius a referendum took place in December 2014, followed by one in Bonaire in December 2015; the outcomes of both revealed that the current configuration was viewed negatively (Leidel-Schenk 2014, Posthumus 2015). A recent evaluation committee has published a critical report (Spies et al. 2015), to which both parties at the time of the interviews were drafting a response. Though restructuring may not happen, interviewees from both sides agreed that significant changes are needed

(Interviewees 8, 14, 15). The interviewees indicated that these discussions take up much time and energy that could be better spent differently (Interviewees 5, 7, 8, 14). IAS management is not a top priority in the ongoing discussions with the Netherlands about the configuration, and might be one of those topics that energy could be devoted to if it weren't spent on other topics.

This configuration can be placed towards the polycentric end of the continuum (quadrant 4), given the overarching system that's planned to become stronger, combined with a push for autonomy from the local center. Being a relatively new configuration, the centers are still searching for a balance between autonomy and coherence. Currently, that results in uncertainty about responsibilities and a lack of resources to be spent, as well as attention being addressed elsewhere, all affecting the advancements of IAS policy. In general, the need for more assistance from the metropolis and a wish for more autonomy leads to friction, according to one interviewee (Interviewee 15) since it is a somewhat paradoxical combination. Yet, in the French Caribbean it seems to result in less friction, as we will describe in the following section.

2.4.2.2 French Caribbean

France's Caribbean territories became Départements d'Outre-Mer (DOM) in the constitution of 1946. Constitutional changes pushing for decentralization in 1982, 2003, and 2008 have resulted in the constitution now referring to Département et Région d'Outre-Mer (DROM), where deviations from French law are allowed only in specific cases. Next to this, there exists the form of Collectivité d'Outre-Mer, for which specific statutes lay down how the territory is governed (Assemblée Nationale Française 1958, Article 74). Guadeloupe, Martinique, La Réunion, and Guyane (French Guiana) are the Caribbean DROM, governed by local offices of the national ministries, and a locally elected Regional Council and General Council. All French laws apply (Mrgudovic 2012) and thus the jurisdiction of France extends over the islands. Some deviations are allowed, but these are rare and do not apply to nature management (Mrgudovic 2012, Interviewees 3 and 16). For IAS this thus means that the French standards are adhered to. The present *overarching system* is elaborate, but there is clear evidence of decentralization by the national government (Interviewees 3 and 16). According to Mrgudovic, Sarkozy's proactive pursuit of decentralization in 2008 was "…an official attempt to put an end to the vicious cycle of dependency…" (Mrgudovic 2012, 94-95). However, she states that the DROM are not very keen on receiving more autonomy, and interviewees stressed that the high standard of living in Guadeloupe cannot be sustained by the island's economy alone (Interviewees 1, 2, 3).

With regard to Guadeloupe and France sharing a common goal, the differences in impact of IAS between the islands and mainland France make this difficult (Interviewees 1, 3 and 16). This might be why the *autonomy of decision-making centers* in relation to

the topic of IAS is moving slowly from low to moderate. The most important actor for nature management is still the local office of the national ministry (Interviewees 1, 2, 3, 4). This does not mean that Guadeloupe agrees with everything France imposes: interviewees gave the example of the National Biodiversity Agency that is currently being set up. Instead of setting up a joint committee for Martinique and Guadeloupe, Guadeloupe ensured separate committees (Interviewees 2, 3). This will result in the islands themselves having more responsibility for nature management (Interviewees 2, 3). As mentioned earlier, the regional council is developing a nature management framework for Guadeloupe; according to one interviewee this is to show Guadeloupe's capacity to surpass the national state (Interviewee 1). With the councils taking more responsibility, the overlapping jurisdictions of nature management might eventually become parallel. An interviewee from the French ministry indicated that the islands were increasingly setting out strategies themselves and turning to the metropolis solely for support (Interviewee 16). This continuous tweaking of responsibilities also shows a high two-way awareness among the two tiers of government. Thus, although the autonomy is rather low, it appears to be increasing, and IAS management would increasingly be tailored to Guadeloupe's needs.

The *coherence* between France and Guadeloupe appears high at first sight. Their DROM status implies integral application of French laws, and within the European Union they are UPRs, meaning that EU laws also apply. Furthermore, they are the only overseas territories that are part of the European Customs Zone (Muller 2001, 442). As mentioned earlier, Guadeloupe is financially heavily dependent on France (Interviewees 1, 2, 3). It is difficult to obtain a breakdown of the expenditures per island, since all three are paid out of a general ministerial budget. However, in 2009 it was calculated that annual expenditure on overseas territories was €16.7 billion, of which €7 billion was thought to be what the ministries specifically spent on the territories instead of in France (Crouzel 2009, Lautrou 2009). The expenditure on Guadeloupe in 2009 was allegedly €2.5 billion (Crouzel 2009), which is much higher than the expenditure by the Netherlands (of approximately €300 million) on Bonaire, Saba, and St. Eustatius[11]. It is transferred to local offices of the ministries as lump sum. Although the civil servants in these offices are typically seconded from France (Interviewee 2), the nature management priorities set in Guadeloupe sometimes lead France to force the local government to change them (Interviewee 1). Conversely, Guadeloupe is guiding France on the topic of IAS by raising awareness and gaining experience in managing IAS (Interviewee 1). The dependency is therefore mutual. The islands do not collaborate much with other islands in the Caribbean, though they do host the secretariat for the international SPAW

1 However, when translated into expenditure per capita, the amounts are quite similar.

convention. An important reason for the limited collaboration is the language barrier (Interviewees 1, 3).

The interviewees differed in their perceptions of the influence of the EU: one stated that it was the EU directive on IAS that led Guadeloupe to take up that topic (Interviewee 4), whereas other interviewees disavowed any influence of the EU apart from applications for the BEST funds (Interviewees 1, 2, 3). Interviewees did not criticize the amount of attention paid to the islands by France, but Interviewee 3 criticized the lack of understanding when drafting policies for which the local government was then answerable to their constituency (Interviewee 3). Others objected that France helps Guadeloupe greatly to manage its own affairs, e.g. by supplying ample funds (Interviewees 1, 2, 3). Interestingly, one interviewee indicated that the ministry complained about getting little response from the islands to requests for updates or invitations to collaborate (Interviewee 1).

In terms of *stability*, there have been many changes to the islands' constitutional status: in 1956, 1982, 2003, 2008 (Mrgudovic 2005). However, interviewees considered the configuration to be evolving, but not very unstable. The role of the regional council is slowly developing and some responsibilities are being devolved, but interviewees considered the tie with France to be constant, given Guadeloupe's dependency on France (Interviewees 1, 2, 3). The stability of the bond is therefore moderate, making for a moderate degree of coherence of the local decision-making centers with France.

Overall, the French case is currently on the more monocentric end of the polycentricity continuum (quadrant 2), with a moderate degree of coherence, an elaborate overarching system, and low autonomy of the local centers. For development of IAS policy the resources transferred from France to the island are a crucial enabling factor, and France ensures a certain minimum is adhered to. This strong overarching system is thus beneficial for policy development. Interestingly, at the same time they appear to be obtaining more autonomy, which allows them to cater to their specific circumstances. The configuration might thus end up closer towards the polycentric end of the continuum, quadrant 1.

2.4.2.3 British Caribbean

Britain has 14 Overseas Territories (OT), falling under the sovereignty of Britain and with the Queen as their head of state. However, they are not British territory and the UK is adamant that they do not belong on the UN's list of non-self-governing territories (FCO 2008). This ambiguity characterizes the judicial consolidation of the relationship between the UK and its OTs (Hintjens and Hodge 2012), starting with the fact that unlike France and the Netherlands, the UK does not have a codified constitution. Instead, an aggregate of treaties, court rulings and laws together make up what is considered the constitution (Bogdanor 2005). The relationship between the UK and its territories

is therefore laid down in the latter's respective constitutions. Anguilla's constitution stipulates that the executive power vested in the Queen is exercised by the Government of Anguilla (Government of Anguilla 2008, art. 26). This appears to grant the OTs great autonomy, but formally the UK parliament has unlimited power to legislate for the territories (FCO 2012, 14). The responsibilities of the UK toward the OTs are rather vague: "…to ensure the security and good governance of the Territories and their peoples" (FCO 2012, 13), but the responsibilities also comprise external affairs, defense, internal security, and the appointment, discipline, and removal of public officers (FCO 2015). Either way, the UK demands to be involved in drawing up the constitutions of the islands, in order to ensure it obtains the powers it needs to meet these so-called "contingent liabilities" (FCO 2008). Other than that, the day-to-day involvement of the UK appears minimal. Interviewees indicated they rarely collaborate directly with people in UK government (Interviewees 9, 12, 13) and to their knowledge no UK legislation applies to their biodiversity management, let alone IAS policy (Interviewees 11, 12). Regarding nature management, the UK plays no role other than distributing project funding (Interviewees 9, 10, 11, 12). A consultative council of OT and UK ministers meets annually (FCO 2012), but the interviewees did not mention anything coming out of that (Interviewees 9, 10, 11, 12). Overall, the autonomy of the local decision-making centers is high, and IAS policy is instigated locally. Some of the interviewees would like to see more effort put into IAS policy (Interviewees 9).

The *overarching system* is very lean. Interviewees were aware of several white papers issued in the UK and dealing with biodiversity management on the islands (e.g., Defra 2009), but did not use them in practice (Interviewees 9, 11). In general, they felt the UK has a very hands-off attitude, only intervening when real trouble arises in terms of natural disasters or deep corruption (Interviewees 9, 10, 11, 12). The official line of the UK is that it focuses on having the powers to be able to "…discharge its responsibilities" (FCO 2008, 4). The overarching system is in practice thus absent, since no coordination between decision-making centers takes place, and certainly not regarding nature management. Part of the interviewees suggested that a stronger overarching system would be conducive to environmental standards being elevated (Interviewees 9, 10).

The coherence of the territories with the UK differs greatly from the French and Dutch cases in financial terms. The OTs have their own tax system and receive only project funding from the UK. The FCO operates a Strategic Program Fund for the Overseas Territories, which in 2014/15 had a value of £4.7 million (FCO 2015). Apart from this funding, "reasonable assistance needs of the Territories are a first call on the UK's international development budget" (FCO 2012, 13), but there is no record of what this amounts to. Compared to the Dutch €300 million for three islands, and the French €7 billion for twelve, the UK's transfer is very low. Still, the FCO stresses the need for the territories to "…do everything they can to reduce over time their reliance on subsidies from the

UK taxpayer." (FCO 2012, 14). In terms of the OTs' insularity, they work closely together with other members of the Organization of Eastern Caribbean States, an association of former British colonies in the Caribbean (Interviewees 9, 10, 11). The OECS is also the organization that drafts laws and regulations for the OTs, which are adapted per OT (Interviewee 9). There is collaboration with surrounding islands, regardless of the nation they belong to, and with the USA through Santo Domingo (Interviewees 11, 12). Instead of having bonds with the UK, the islands have bonds with countries and territories in the region, and interviewees expressed the sentiment that the UK government pays little attention to them and their needs (Interviewees 9, 10, 11). Geopolitically, they are not part of UK territory and within the EU hold OCT status, which means that barely any UK and EU legislation applies (Hintjens and Hodge 2012). Regarding resource interdependencies, interviewees indicated not to depend on the UK for anything (Interviewees 9, 11), even though the UK could potentially mean a lot to them (Interviewee 10). Thus the integration is not tight.

The *stability* of the bond between the UK and OTs is low. From the beginning of the 20th century onwards, attempts were made at establishing some sort of federation in the British West Indies. In 1947 the foundations for such a federation were agreed upon, and in 1958 the West Indies Federation was established, only to collapse four years later. In 1967 "associated statehood" was adopted (Rapaport et al. 1971), but this had also fallen apart by the late 1970s. Anguilla had protested several times during the 1950s and 1960s against the association with St. Kitts and Nevis, and following the '67 revolution came under direct British rule in 1970 and evolved into an OT in 1980 (FCO 2012). From 2000 onwards the UK planned to increase the engagement with the islands, but interviewees contended that the "lack of wanting to know continues" (Hintjens and Hodge 2012, 218, Interviewees 13 and 14). New constitutions were drafted from 2006 onwards, but Anguilla's 2008 draft has still not been endorsed (Government of Anguilla 2008, Hintjens and Hodge 2012).

Overall, the highly autonomous island is in practice barely affected by the overarching system and no coordination between the decision-making centers takes place. Therefore, it doesn't really qualify as a polycentric configuration. For IAS policy this entails that Anguilla has full autonomy to set the standards, with little support and demands. A stronger overarching system might enhance the development of policy by setting standards to be adhered to and providing more resources, but on the other hand, pertaining to the endorsement of the constitution, the UK appeared to be a delaying factor. Although the current IAS activities cannot be qualified as policies put in place, more actions are undertaken than in the Dutch case, possibly since there is no distracting debate about the role of the overarching system.

2.5 DISCUSSION

Our findings are depicted schematically in Figure 4. To recap, we qualify the Dutch case as being on the polycentric end, the French as currently at the monocentric end but moving to the polycentric end, and the British to not fit on the continuum. Regarding policy development on IAS, France has determined some policy and is currently making significant steps, whereas the Netherlands and UK have virtually no such policy in place. The comparative success of the French case with high autonomy for decision-making centers coupled with strong coherence, fits well with the polycentricity literature. The liberty to reach a given end in whichever way, provided coordination takes place, is the core tenet of polycentricity. However, in the Dutch case actors saw a trade-off relation between these two elements, and thus a hard combination to attain. Is it exactly the strong overarching system that incited France to devolve more autonomy to Guadeloupe, feeling like it has a safety net? Could Anguilla's high autonomy be combined with a strong overarching system, and would that be beneficial for policy development? Although insightful, approaching these configurations solely through the lens of polycentricity is not sufficient to understand the development of policy. A governance configuration is more than a neutral structure, and in these cases, the metropoles are very distinct resource-wise from the Caribbean territories. The latter are in general largely dependent on help from the former, while at the same time entertaining strong wishes for autonomous decision-making. Also, the distribution of mandates and responsibilities does not follow logically from a given configuration; Guadeloupe's development of IAS policy was hampered by disagreement about the distribution of mandates and responsibilities for a while. Guadeloupe has that clarified by now, whereas St. Eustatius is still gridlocked. Thus, rather than a neutral structure, through the governance configuration,

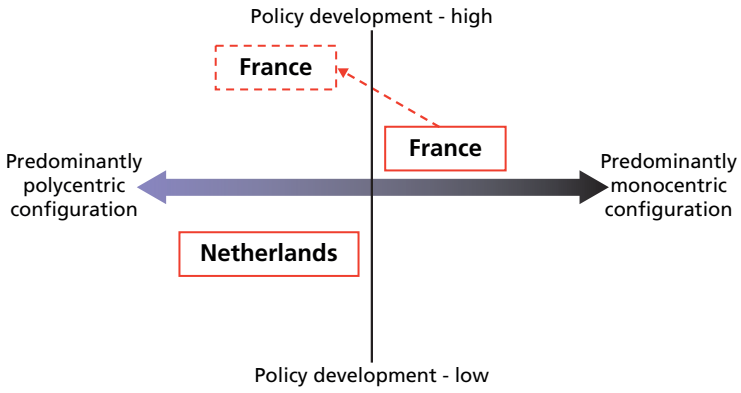

Figure 4. Overview of the results, with the dashed arrow indicating the evolvement of France's configuration. On the vertical axis, the advancement of policy development. On the horizontal axis, the contrast between different polycentric configurations, in neither of which the UK fits, thus left out.

dynamics such as mandate division and resource dependency play out. The concept of "institutional bricolage" advocated by Frances Cleaver within the critical institutionalism literature might be useful for this. Her approach entails a central role for social relations and regards institutions as forged through a messy process of piecing together parts of existing institutions and devising new elements (e.g. Cleaver 2002).

This leads us to point-out some limitations to our research. One, the three islands have very idiosyncratic and historically delicate relationships with the metropolis, making them quite different from e.g. the police departments studied by Ostrom (e.g., Ostrom 1973). Also, topics like health care or education receive much more attention, and focusing on those themes might have yielded very different insights about the influence of polycentric configurations. Lastly, we glossed over phenomena such as nepotism and patrimonialism, which have been described as linked to the size of polities (see Veenendaal 2014) as well as to polities where the institutions embodied by the formal state do not coincide with the practices of daily life (see Feikema 2015). These two characteristics fit the Caribbean islands, and although these dynamics might not affect the structure of the configuration, they may affect its working in practice. It would be interesting to further research this, especially in light of the claims that are made regarding the performance of polycentric arrangements (Folke et al. 2005, Pahl-Wostl and Knieper 2014, Marshall et al. 2016). To what extent do such contextual factors affect the performance of polycentric arrangements? Notwithstanding these limitations, the results offer some insights for answering the research question, which we will proceed with now.

2.6 CONCLUSION

From our results, three findings are worth discussing separately before answering the research question, the first being that the British case cannot be considered a polycentric configuration at all. An overarching system exists on paper, but in practice no coordination takes place between the decision-making centers. Secondly, none of the cases score high on IAS policy development. Guadeloupe is making significant progress, but still has no island-wide policy in place. Thirdly, it appears to be precisely France's evolvement from the mono- to polycentric end of the continuum that is fostering the policy progress, since it allows Guadeloupe to address challenges that are specific to the island, while having ample resources provided by France. For the Dutch case, this is a combination that currently mainly provides tension: the dependency of the island on the metropolis, while needing leeway to be able to design appropriate policy. Being much younger than the French configuration, through time a balance might be struck.

Returning to the research question "how does the type of polycentric configuration of a Caribbean overseas territory and its metropolis influence the development of policy regarding invasive alien species?", we can draw two main conclusions based on our cases. The strong coherence is beneficial to the French case for two reasons. One, because the overarching system ensures a minimum level of environmental policy, and two, because it comprises substantial financial support. Coherence can however not be assumed to always take this shape and have these effects. In the Dutch case, confusion about the role of the overarching system, and contention about concomitant financial resources seems to be the main hampering factor for policy development on IAS. In the British case the overarching system is lacking and no financial resources are transferred, but that is not coupled with contestation and resentment. Hence, agreement on how coherence is structured appears to be pivotal.

What the configuration should look like cannot be derived from three case studies, but we can note that increasing autonomy coupled with strong coherence works well for the French case. The overarching system ensures certain standards to be met, and entails financial support, while the increasing degree of autonomy allows the employment of those resources in the most expedient way. Based on our study we can only speculate about which type of polycentricity would work best for the Dutch and British cases, but it is clear that contention about the governance configuration can be a significant hampering factor.

Chapter 3

“Let me tell you your problems”. Using Q methodology to elicit latent problem perceptions about invasive alien species

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ABSTRACT

From a participatory governance perspective, managing changes in ecosystems requires involvement of stakeholders. However, when the impacts of such changes are unclear or unknown, problem perceptions are latent and stakeholders cannot be identified. To elicit perceptions of an ecosystem change despite unknown impacts, we employed Q methodology regarding landscape values. From these perceptions we derived stakeholder stances on the ecosystem change constituted by the invasive alien plant Coralita (*Antigonon leptopus*) on the Caribbean Netherlands islands of St. Eustatius and Saba. Ecologists view Coralita as a clear threat, but the exact impacts of the plant are unknown and therefore locals do not have manifest problem perceptions. Nevertheless, we derived three perspectives on the value of nature per island, which in turn yielded insights into stakeholders' views on Coralita management. Our approach can be applied for other management questions regarding changes in ecosystems when the impacts on humans are unclear and hence problem perceptions latent.

3.1 INTRODUCTION

Biodiversity decline and ecosystem degradation are causing great worry to ecologists and environmental scientists, some of whom believe they herald the onset of the earth's sixth mass extinction (Barnosky et al. 2011). However, the impacts on people of many of the changes to ecosystems are unclear, and therefore problem perceptions among actors are latent. An example is the decline in insect abundance, for which the impacts on people are hard to define, resulting in little priority being given to slowing the decline (Brugh 2017, Vogel 2017). Another example: changes to the nitrogen cycle, which affect processes like eutrophication and acidification whose impacts on people are difficult to define precisely (Galloway et al. 2014, Reis et al. 2016). The impact of an ecosystem change can be unclear due to the complexity of the phenomenon or uncertainty about its materialization (Renn et al. 2011). It could be that if the impacts were clarified, people would be able to articulate their perception and stakeholders could be identified. But in this chapter we work on the premise that these impacts cannot be clarified and that this hampers people from articulating a perception, rendering their perceptions latent. This latency makes it difficult to identify stakeholders that could be engaged in governance activities, resulting in a significant problem from a participatory governance perspective. We propose a method for identifying stakeholders despite latent problem perceptions, which we test on the case of invasive alien species (IAS) management in the Caribbean Netherlands.

Participation of stakeholders is crucial for IAS management for several reasons. One is that problem perceptions of IAS are not defined by factual knowledge, but by value orientations, attitudes and underlying belief systems (Stokes et al. 2006, Verbrugge et al. 2013, Humair et al. 2014). For example, feral hogs on Hawaii are considered by scientists as an IAS that needs to be eradicated, whereas locals view the hogs as bounty and as important in cultural practices (Weeks and Packard 2009). If these different perceptions are not represented, policy processes are hindered (Sharp et al. 2011, Shackleton and Shackleton 2016). A second reason is that management of IAS requires unanimous cooperation given its weakest-link public good character (Niemiec et al. 2016). This becomes a challenge when impacts of species are unclear (Hulme 2006), as is the case for coral vine (*Antigonon leptopus*) on the Caribbean Netherlands islands Saba and St. Eustatius. Little research exists on the impacts of the vine, but it has been documented to rapidly cover vast areas and as very tough to remove due to its tuberous roots (Burke and diTommaso 2011). It is deemed a threat to biodiversity, including to the native iguana (van der Burg et al. 2012), and is generally considered a serious risk in the Caribbean Netherlands by ecologists (Jongman et al. 2010, Smith et al. 2014). But impacts are very hard to specify further, and there's even uncertainty about which impacts might occur (Sweeney 2018). Hence, stakeholders' problem perceptions are latent and there

are no prospects of providing them with information to enable them to articulate their perceptions.

We propose and test an approach to identify stakeholder groups despite latent problem perceptions. It consists of two main elements: Q methodology to map the range of extant perspectives, and focusing the analysis on landscape values rather than invasive species. From the resulting perspectives on landscape values, we elicited problem perceptions about IAS, as well as views on the appropriateness of conservation efforts. Thus, this chapter contributes to the participatory governance literature by exploring how to identify stakeholders even in cases of latent problem perceptions. This can be of value in similar cases of ecosystem changes whose impacts on people are unknown.

3.2 PARTICIPATORY GOVERNANCE AND INVASIVE ALIEN SPECIES

Participatory governance is increasingly advocated for and applied to environmental and ecological challenges (Folke et al. 2005, Papadopoulos and Warin 2007, Armitage 2009). Participatory governance promotes more inclusive and less top-down forms of management and stresses the involvement of actors who would normally not be engaged in decision-making, such as locals (Newig et al. 2018). Arguments for increased participation of stakeholders can be categorized as being normative, substantive or instrumental (Glucker et al. 2013). Normative arguments include, for example, that participation has an emancipatory effect on otherwise underrepresented groups (Dietz and Stern 2008), fosters social learning and allows those affected by a decision to influence it, increasing the democratic value of a process (Glucker et al. 2013). Substantive arguments expect greater effectiveness of participatory governance, since stakeholders are a valuable source of local, experimental and value-based knowledge and insights (Bulkeley and Mol 2003, Glucker et al. 2013). Instrumental arguments hold that acceptance and compliance are higher in actors who have been involved in the decision-making process, and that the legitimacy of a participatory process is greater (Koontz and Thomas 2006, Dietz and Stern 2008). These alleged strengths of participatory governance have resulted in different practices of stakeholder involvement in management of ecosystems and natural resources: for example, communities managing resources through collective institutions (Ostrom 1990, Dietz et al. 2003), through adaptive co-management (Berkes 2009), community-based natural resource management (Dressler et al. 2010), or as collaborative networks in ecosystem-based management (Bodin et al. 2017).

Naturally, participatory governance is not a panacea and shortcomings and threats have received ample attention in the literature. For example, Dressler et al. (2010) showed for several cases of community-based natural resource management how the resource was not managed more sustainably nor more equitably. When conservation

was prioritized, communities sometimes ended up with less of a say in the management of their resource than before the program (Dressler et al. 2010). Fletcher (2017) stresses the importance of analyzing governance strategies and structures through which conservation is enacted, since stakeholders' positions are grounded in different "governmentalities". "Governmentality" is a portmanteau term coined by Foucault from "governing" and "mentality" (see Hanson 2012); it designates strategies, discourses and structures through which power is enacted (Buseth 2017, Fletcher 2017). There exist multiple governmentalities (e.g. neoliberal, disciplinary, truth), and conservation practices come about through their interplay (Fletcher 2017, Montes and Bhattarai 2018). Participatory governance thus does not guarantee that governance will be either sustainable or equitable if the governmentalities of the actors involved lead to different positions on what is appropriate environmental management. On a more practical level, several shortcomings have been pointed out as well. Bockstael et al. (2016) provide an overview of criticisms of participation made in the development literature. Factors they mention are: local elites capturing the rights that are devolved to a decentral level; power imbalances not being taken into account; a technocratic approach to participation; too strong a focus on the local situation and neglecting the broader institutional context; assuming every local community is similar; co-opting participation to promote different interests; and devolving responsibilities without the corresponding resources (Bockstael et al. 2016). Mentioned regularly is the limited capacity of participatory approaches to solve situations with strong conflicts (Newig and Fritsch 2009); it might increase conflicts (Walker and Hurley 2004) or serve merely a symbolic purpose (Sotirov et al. 2015).

Thus, participation is in itself not a guarantee for making environmental governance socially and ecologically successful. But the literature does point towards a few conditions and contextual factors that can enhance the performance of participatory governance. Based on Natura2000 experiences, Blondet et al. (2017) confirm the claims made by Turnhout et al. (2010) and Van der Arend and Behagel (2011) that extant conservation practices mediate the materialization of participation. As a result, Blondet et al. (2017) find that participation mainly affects the usual suspects but does really grant them more influence. This is what the risk of elite capture is grounded in. Crucial to prevent that are local leadership and the integration of multiple perspectives and processes to resolve conflicts (Mc Morran et al. 2014). Also pointed out frequently is the importance of taking the community's livelihood into account, and how conservation efforts would affect the resources the community depends on (Gardner et al. 2016, Bluwstein et al. 2016). For communities to participate successfully, there must be substantial benefits for them from the proposed conservation efforts, and decision-making must be well-informed (Bluwstein et al. 2016). Additionally, they should be involved in management tasks related to the area or resource (De Pourcq et al. 2015). Sometimes contradictions arise as well: for example, Bluwstein et al. (2016) assert that real power needs to be

devolved to democratically elected bodies, while Ece (2017) shows how such a devolvement of responsibility can actually make an institution less capable of representing its constituents. Similarly, trust and other aspects of social capital are often mentioned as conducive to participatory governance (De Pourcq et al. 2015, Blondet et al. 2017), while strong bonds among participants can also result in coalitions that exclude others (Mc Morran et al. 2014). Lastly, it has been suggested we change our perspective or frame of reference when looking at participatory governance. Bouamrane et al. (2016) discuss biosphere reserves in Africa and France, arguing that when trying to reconcile developmental and conservation efforts, ecological solidarity is a more appropriate frame than human–nature interdependency. De Pourcq et al. (2015) argue that effectiveness of participatory governance should be assessed in terms of conflict prevention, and their study shows good outcomes for co-management of that issue.

Overall, while participation may have its shortcomings and pitfalls, involvement of the local community is in principle preferable over no involvement at all (Turnhout et al. 2010, Lührs et al. 2018). To that end, there is a wide range of literature available on stakeholder analysis and involvement methodology (e.g, Vasslides and Jensen 2016, Lopes and Videira 2016). We argue that for our case, the applicability of such approaches is limited given the unclear impacts on people of the ecosystem change at hand. This is because even when the stakeholder-involvement approaches acknowledge that stakeholders' preferences are often unarticulated, the approaches do assume that stakeholders can be identified and their preferences elicited (e.g., Tompkins et al. 2008). We contend that when impacts on people are unclear, problem perceptions are latent and hence stakeholders cannot be identified. The objective of this chapter is therefore to develop and validate a method for ascertaining stakeholder stances in such situations, in order to allow for proper stakeholder involvement notwithstanding latent problem perceptions. Specifically, we aim to show how Q methodology can be used for eliciting latent problem perceptions. First, however, we discuss some details of the case.

3.3 INVASIVE ALIEN SPECIES ON SABA AND ST. EUSTATIUS

Ecologists list IAS as one of the major threats to biodiversity, with cost estimates ranging from €12 billion a year for the EU to €120 billion a year for the USA (Pimentel et al. 2005, Shine et al. 2010). On islands they are generally assumed to be an even larger threat to biodiversity because island ecosystems are fragile (Kairo et al. 2003, Reaser et al. 2007), although not everyone agrees (see Sax 2008, Vilà et al. 2011). Notwithstanding, there is a lot to be lost on Caribbean islands, as one of the world's 25 global biodiversity hotspots with about 60% of the region's 12,000 plant species being endemic (Mittermeier et al. 1998, Kairo et al. 2003).

We conducted our study on Saba and St. Eustatius (commonly known as Statia), part of the Caribbean Netherlands: see Figure 5 for a map. Saba measures 13 km^2 and as such is the smallest of the two. It is the northernmost island of the volcanic inner arc of the Lesser Antilles and was formed about 500,000 years ago, making it younger than other islands in this region. The peak of the dormant volcano, surrounded by a few domes, rises out above the Caribbean sea to 872 m. There is still a lot of geothermal activity, and because of the steep rocky coastline, erosion is an issue in many places. The slopes sometimes exceed 60° or are even nearly vertical, making agriculture difficult. Thus, the largest source of income is tourism (de Freitas et al. 2016, CBS 2017). Statia is located about 30 km southeast of Saba, has a population of 3200 people and is slightly larger: 21 km^2. It has a dormant volcano known as The Quill, which forms the highest point of the island at 600 m. During the colonial period it accommodated about 70 plantations, mainly located on the flat areas in the center of the island. Currently, some agriculture still takes place, but the main economic activity is the oil terminal of the US company NuStar (DLG 2011, de Freitas et al. 2012, CBS 2017).

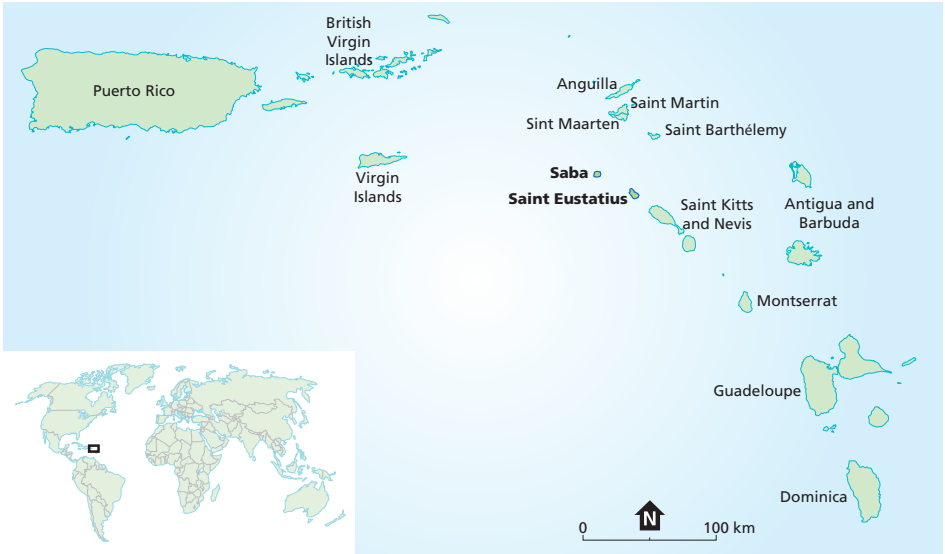

Figure 5. Map of the research locations

On both islands the invasive alien plant Coralita (*Antigonon leptopus*) is known to smother native vegetation and overgrow the nesting sites of the already endangered native *Iguana delicatissima* (van der Burg et al. 2012). On Statia the plant is estimated to cover 15–20% of the island (van der Burg et al. 2012), predominantly former agricultural land but also land on the borders of the national parks. On Saba, Coralita is starting to creep up the mountain that is crowned with a unique elfin forest which attracts many

tourists (van de Kerkhof et al. 2014). Reports written to support Coralita management so far have not taken stakeholders' perspectives into account (e.g., van der Burg et al. 2012, Smith et al. 2014), perhaps because there are no identifiable stakeholder groups.

Although the Coralita invasion is a very visible phenomenon, during previous fieldwork we were repeatedly confronted with the absence of clear stakeholder groups. Locals all know the plant: some regard it a nuisance in their garden, while others find the flower beautiful. But a lack of knowledge about the vine's impacts was often mentioned as obstructing decision-making. Given the limited scientific understanding and knowledge of impacts of IAS, this gap cannot easily be filled (Barney et al. 2013). Thus, people are hampered in articulating their perceptions of the change to the ecosystem, and these latent problem perceptions make it impossible to identify stakeholders to involve in Coralita management. In this chapter we aim to elicit problem perceptions so that stakeholder groups can be identified and involved in the decision-making process regarding Coralita.

3.4 METHODOLOGY

3.4.1 Q methodology and landscape values

Q methodology was introduced by William Stephenson in the 1930s (Stephenson 1953), applying ideas from quantum physics to the study of subjectivity. Wanting to diminish the influence of the researcher on data gathered from respondents, Stephenson proposed a method to collect self-referent expressions and find order across them. The underlying assumption is that such self-referent expressions can be understood as a form of behavior and are an adequate representation of subjective meanings (McKeown and Thomas 2013). This is considered an improvement over approximating respondents' subjectivity through objective traits and characteristics, which is at the center of conventional R analysis (Steelman and Maguire 1999). More concretely, this means that while covariation between variables across participants is usually the object of interest, what is of interest for Q is covariation between persons' perspectives (i.e., their Q sorts) across statements (Webler et al. 2009). Though initially applied in psychology, Q methodology is increasingly being applied in environmental research to understand human perspectives regarding, for example, conservation issues: topics range from the necessity of conservation (Sandbrook et al. 2011) to the why and how of climate adaptation (Uittenbroek et al. 2014). A recent review of 52 articles applying Q methodology on nature conservation discerned four general aims of Q methodology: addressing conflict, devising management alternatives, gauging policy acceptability, and reflecting on values implicit in research and practice (Zabala et al. 2018). Such different aims can be realized because of the structured and in-depth representation of people's thoughts

generated through Q methodology. Structured, since the methodology forces people to order each thought in relation to every other thought; and in-depth, because it queries people's thinking about a topic through a variety of statements (Webler et al. 2009). Q can be applied for understanding human perspectives on three analytical levels. One, to simply map perspectives in a qualitative manner, revealing perspectives on a certain topic (Uittenbroek et al. 2014), is frequently used as a proxy for discourses (Webler et al. 2009). Two, because of the structured and in-depth approach, Q is used to uncover value patterns underlying people's attitudes, explaining why people hold certain perspectives (Ellis et al. 2007). Three, building on that, a shared value system can be developed among stakeholders, which is considered crucial for community-based governance (Gruber 2011). Q has, for example, been used to find common ground between contradictory problem narratives about the much contested issue of large carnivore conservation (Mattson et al. 2006). We aim to employ the capacity to uncover underlying value patterns for eliciting stakeholders' latent problem perceptions.

This is a new use of Q methodology, and different from the application by Mazur and Asah (2013) to reveal latent agendas fueling conflict about the recovery of the grey wolf in Washington State. Their Q study showed that people asserting that wolves and society are incompatible in fact express discontent about the conditions under which wolf recovery projects would be executed. By also acknowledging marginalized or hidden views (Zabala et al. 2018), Q methodology brought to the fore beliefs that a regular survey might have missed. Based on their findings, Mazur and Ash (2013) assert that addressing the seemingly peripheral apprehension about legal arrangements of the project will ameliorate people's stance on incompatibility. The latency addressed in that article differs from ours, in that their topic in itself is much contested and one about which actors have strong opinions. We, however, are interested in a topic on which views are not strong, which brings us to the second innovative aspect of our approach. Q has been applied sporadically in invasive species research (e.g., Falk-Petersen 2014, Hamadou et al. 2016), but never regarding what Zengeya et al. (2017) refer to as "inconsequential species". We assume that although perceptions about Coralita are latent, people are capable of articulating their opinion about nature's value, and this can be linked to potential impacts of Coralita. We therefore used the landscape services typology proposed by Van Riper and Kyle (2014) as the basis for our Q statements, which has not been applied this way before.

Before explaining how we designed our study, we would like to draw attention to some important limitations of Q methodology. The most important being that it reveals the diversity of opinions present across participants, but not their relative prominence. That is to say, at the end of a Q study you know the ways in which people think, but not how many people think in a certain way (Sandbrook et al. 2013). This could be remedied by combining it with a large-scale survey, for which Danielson (2009) offers several

approaches. Moreover, the method is cognitively rather demanding for participants, and the researcher needs to construct a set of statements that is comprehensive, yet for respondents possible to grasp and sort in a reasonable time span (Mukherjee et al. 2018). In the following we will explain how we dealt with these concerns in the design of our Q study, followed by its application.

3.4.2 Designing the Q study

The ability of Q to uncover underlying values in a relational manner is due to the structured way in which participants are asked to relay their opinion. Each participant receives a set of statements on cards and is asked to place them on a normal-curve-shaped grid according to their own views on the topic, as depicted in Figure 6. Allowing more cards to be placed in the middle than towards the extremes forces the participant to articulate their opinion. The result is called a Q sort (Webler et al. 2009, McKeown and Thomas 2013).

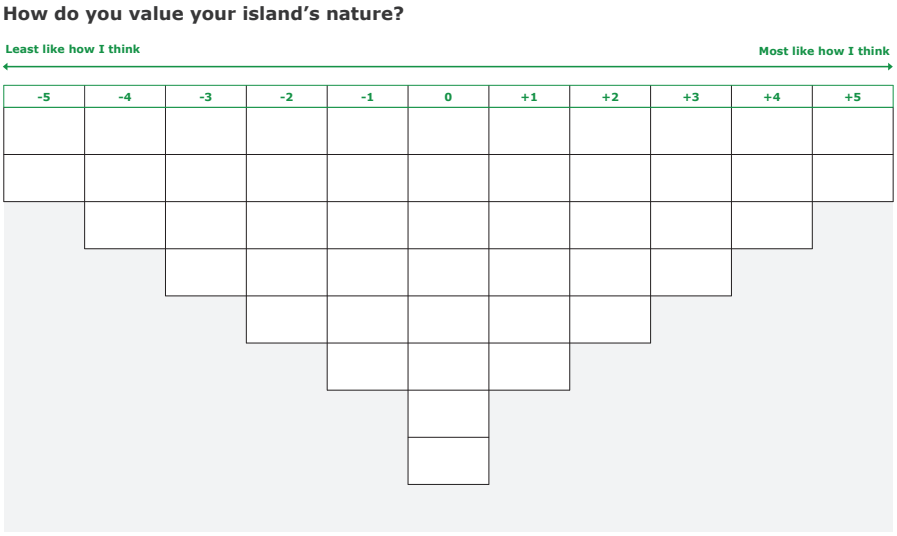

Figure 6. Board used for Q sorts

The statements can be gathered in two ways: structured or unstructured. Unstructured approaches aim to collect an all-encompassing "concourse" (Q-terminology for corpus) of statements from which a representative sample is taken. Structured approaches are appropriate when the research is based on a theory that entails certain concepts and views, for example, or when it is not feasible to collect an all-encompassing concourse (Watts and Stenner 2012). Because there has been scant public debate in the Caribbean Netherlands about invasive species, there was no extant concourse to draw from and we

constructed the sample. As mentioned earlier, we used the landscape services typology, which has been promoted as being appropriate for assuring stakeholder involvement, since it reflects local relevance and centers around values to humans (Fagerholm et al. 2012). We used the values discerned by Van Riper and Kyle (2014), based on Raymond and Brown (2006). We adapted the values to make them applicable for Saba and St. Eustatius: see Table 4.

Landscape values	
Aesthetics	Attractive scenery, sounds and smells
Agriculture and livestock	Agriculture[a] and livestock providing income and food
Biodiversity	The variety of plants, wildlife, marine life and other living beings
Future value	Allowing future generations to experience Saba/Statia the way I experience it
Intrinsic	The importance of nature in and of itself
Medicine	Plants or animals with medicinal and therapeutic powers
Recreation and relaxation	Undertaking outdoor activities to recreate and unwind
Science and learning	Scientific activities and learning about Saba's/Statia's nature and culture
Spiritual and religious	The spiritual or religious meaning of Saba's/Statia's nature
Supporting cycles	The cycles that produce clean air, soil and water
Tourism	Attracting tourism which provides employment and income
Utilities	Clean drinking water and electricity generation through solar and wind power

Table 4. Landscape values for Saba and St. Eustatius, contextualized based on Van Riper and Kyle (2014).
[a] By agriculture, we mean the growing of crops and fruit.

Overlap between the values as seen by participants is discussed in the Results section. We take the concern raised by Mukherjee et al. (2018) regarding bias in the selection of statements to heart, and therefore included every landscape value, irrespective of our expectations regarding its relevance. Pertaining to each substantive value, we formulated four statements, following Dryzek and Holmes' (2002) typology of discursive claims that make up a perception, as described in Table 5. We thus had 48 cards with statements regarding the value of nature on the respective islands, which we think is still within the limits of what respondents are able to grasp in one interview.

Discursive element	**Meaning of element**	**Translation into statement**
Definitive	Concerned with the meaning of terms	This is an important value of Saba's/Statia's nature
Designative	Concerned with matters of fact	This value is under pressure
Evaluative	Concerning the worth of something that exists or might exist	If Coralita would impact this value, I would be worried
Advocative	Concerning something that should or should not exist	We should protect this value

Table 5. Four discursive claims and their translation to our cases, based on Dryzek and Holmes (2002).

3.4.2.1 Discourse typology

To have some handles for interpreting the perspectives yielded by the Q sort, we link them to five discourses identified for rural landscapes in Europe (Elands and Wiersum 2001, Hermans et al. 2010). Table 6 shows which landscape values we consider to be connected to each discourse, given the description of the discourse in the literature. We do not aim to link each perspective we identified to one of the perspectives discussed below but have characterized them heuristically by comparing them to this typology.

Discourse	**Definition** (Frouws 1998; Hermans, Horlings, Beers and Mommaas 2010; Elands and Wiersum 2001)	**Landscape values**
Agri-ruralist	Farming is the main value of the landscape, supplying society with a wide range of amenities such as food, drinking water, attractive landscapes and recreational facilities.	Aesthetics; agriculture and livestock; recreation and relaxation; utilities
Utilitarian	Landscape is a production area, an integral part of the economy, and not necessarily just for food. Governed by market forces.	Agriculture and livestock; tourism; science and learning; utilities
Hedonist	Landscape contributes to the quality of life through quietness and naturalness, as opposed to the crowdedness of the urban, providing an escape.	Aesthetics; biodiversity; recreation and relaxation; spiritual and religious; tourism
Community sustainability	Landscape should support the rural society by offering goods and services, and be managed by government rather than be market-driven.	Aesthetics; agriculture and livestock; utilities
Nature conservation	Ecological integrity should be maintained, wilderness retained. A balance should be found between use and conservation.	Aesthetics; biodiversity; tourism

Table 6. Discourse typology with the corresponding landscape values

We expected to find different perspectives on the two islands, due to some conspicuous differences between them. Saba attracts approximately 22,500 tourists a year, making tourism the most important economic sector. For Statia this figure is much lower at 10,000 a year, with the oil terminal as the most important economic sector. In addition, over 70% of the visitors to Saba go for a hike, compared with less than 40% on Statia, where diving is the main tourist attraction (van de Kerkhof et al. 2014, van de Kerkhof, Schep, van Beukering, Brander and Wolfs 2014). On Statia, the Department of Agriculture has set up a farm for use by locals, aiming to reignite interest in agriculture (The Daily Herald 2017). Saba has barely any flat land, so farming is much more small-scale. Hence, for Saba we expected to find perspectives resembling the *hedonistic* and *natural conservation* discourses, emphasizing the landscape values of tourism, aesthetics, relaxation and recreation, and biodiversity. For Statia we expected to find perspectives resembling the *agri-ruralist* and *utilitarian* discourses, with agriculture and livestock, utilities and medicinal values of the landscape featuring most prominently. Looking for these dif-

ferences is relevant for two reasons. One, to see if our approach is nuanced enough to pick up on such differences and bring them to the fore in the results. The differences in perspectives are important to ensure management efforts can be attuned to local priorities, which is the second reason why we wanted to check for such differences.

3.4.3 Conducting Q sorts

Having constructed the Q statements, the next step is to define the sample of participants, which differs in two important ways from other common stakeholder analyses. One is that since the purpose is to relay the breadth of opinions, the sampling is purposive rather than random (Zabala et al. 2018). This entails selecting participants whose opinions the researcher expects to be diverse, and the aggregate of which can be assumed to be representative of the population (Webler et al. 2009). Secondly, due to the inverse statistical analysis mentioned earlier, the need for a large sample size applies to the Q statements, whereas the sample of participants should be smaller (López-i-Gelats et al. 2009, Zabala et al. 2018). Webler et al. (2009) mention a ratio of 1:3 for the number of participants to the number of statements. Also restricted by the earlier-mentioned cognitively demanding sorting process for the statements, we collected sorts from 16 participants on Saba, and 32 on Statia from which we randomly selected 16. The larger number of interviews on Statia reflects the island's larger population and our wish to represent all their perspectives. We selected participants whom we expected to have a range of very different thoughts about the value of nature, to make sure we would elicit the breadth of opinion regarding the value of nature. Hence our participants were as much as possible evenly distributed across nature management organizations, the agricultural sector, government, education and tourism, and we also included citizens with no clear stakes regarding nature. Two other important selection criteria were their availability (since the interview took close to an hour) and their cognitive capacities (sorting 48 cards with hypothetical statements in a relative manner requires a high level of abstract thinking).

Participants were instructed to sort the cards by placing each statement in a column ranging from −5 ("least in line with my thinking") to +5 ("most in line with my thinking") as shown in Figure 6. We explained which statements to expect beforehand and suggested the participants first divide them in two stacks: agree or disagree. Some of them did so. We gave no specific information regarding Coralita or the state of nature on the islands, since we were interested in extant perceptions. If a participant asked us, for example, about Coralita's impact on biodiversity, we shared our knowledge on that. During the ordering process we engaged in conversation about the participant's thoughts, to clarify interpretations of the statements. We have integrated our notes in the result section, along with the factor analyses of the Q sorts.

3.4.4 Analyzing the Q sorts

We conducted a Principal Component Analysis (PCA) with Varimax rotation on the sorts, using PQmethod (Schmolck 2014). PCA is applied frequently in environmental research to extract uncorrelated axes of variation (Cheng and Mattor 2006, Falk-Petersen 2014, Spruijt et al. 2016). Concerning factor extraction, Kaiser's criterion of including all factors with an Eigenvalue > 1.00 and looking at the scree plot of the Eigenvalue of the factors resulted in big differences in the factors included. As suggested by Peter Schmolck via e-mail (p.c. Schmolck 30 April 2017), we therefore adhered to a more iterative selection method, by looking at the resulting factor loadings and the amount of significant sorts for different factor solutions. Significant loading is established with help of the formula ABS(2.58SE) = ABS(2.58/$\sqrt{N}$). SE is the standard error, calculated through 1/$\sqrt{N}$, where N is the amount of statements, i.e., 48. Thus, every loading greater than ABS(0.37), i.e., loading>0.37 or loading<-0.37 is significant ($p<0.01$) (McKeown and Thomas 2013, 53). Following Schmolck, during the flagging procedure, the correlation between factor scores was kept as low as possible, confounding sorts were not flagged and a minimum of three significantly loading sorts per factor was pursued. This resulted in three factors for each island, which we regard as proxies for perspectives, representing views held about a certain topic. They are discussed below.

3.5 RESULTS

3.5.1 Saban perspectives on the value of nature

The data from the Saban participants yielded three main perspectives on the value of nature: *future-oriented nature conservation*, *modern utilitarian* and *optimistic agri-ruralist*. These titles are inspired by the discourses presented in Table 6. We discuss them one by one below and conclude by assessing their implications for reaching agreement on Coralita management. The ranks the participants attributed to the statements are shown in Table 7, organized by landscape value. In Table 7 we have abbreviated the statements as follows: "Important Saba: X" means "X is an important value of Saba's nature"; "Pressure Saba: X" means "X is under pressure on Saba"; "Coralita Saba: X" means "If Coralita would impact X, I would be worried"; "Protect Saba: X" means "We need to protect X on Saba". Tables 26-31 in the Appendix show the ranks per discursive element and per factor, and Table 32 the consensus statements.

Statement	Nat. cons.	Mod. util.	Agri-rur.
Important Saba: scenery, sounds and smells	4	5	2
Pressure Saba: scenery, sounds and smells	-1	2	-5

Coralita Saba: scenery, sounds and smells	2	4	-1
Protect Saba: scenery, sounds and smells	2	1	1
Important Saba: agriculture and livestock	-2	4	4
Pressure Saba: agriculture and livestock	-2	3	-1
Coralita Saba: agriculture and livestock	0	3	5
Protect Saba: agriculture and livestock	-1	0	0
Important Saba: variety of animals and plants	3	2	4
Pressure Saba: variety of animals and plants	0	-1	-1
Coralita Saba: variety of animals and plants	2	1	4
Protect Saba: variety of animals and plants	2	0	1
Important Saba: future generations experiencing	4	2	1
Pressure Saba: future generations experiencing	-1	1	-3
Coralita Saba: future generations experiencing	1	1	1
Protect Saba: future generations experiencing	4	1	-4
Important Saba: nature intrinsically	5	0	3
Pressure Saba: nature intrinsically	0	-1	-2
Coralita Saba: nature intrinsically	1	0	-2
Protect Saba: nature intrinsically	5	-1	2
Important Saba: medicine	-3	-1	1
Pressure Saba: medicine	-5	-4	-5
Coralita Saba: medicine	-3	-2	0
Protect Saba: medicine	-2	-3	0
Important Saba: recreation and unwinding	3	-2	-1
Pressure Saba: recreation and unwinding	-3	-2	-3
Coralita Saba: recreation and unwinding	0	-3	-3
Protect Saba: recreation and unwinding	2	-3	0
Important Saba: science and learning	1	2	0
Pressure Saba: science and learning	-2	-3	-2
Coralita Saba: science and learning	-1	-1	-2
Protect Saba: science and learning	1	2	-1
Important Saba: spiritual and religious	0	-5	2
Pressure Saba: spiritual and religious	-5	-4	-2
Coralita Saba: spiritual and religious	-4	-4	0
Protect Saba: spiritual and religious	-3	-5	0
Important Saba: clean air, water and soil	0	1	2
Pressure Saba: clean air, water and soil	-4	0	-3
Coralita Saba: clean air, water and soil	-2	3	1
Protect Saba: clean air, water and soil	1	0	3
Important Saba: tourism opportunities	3	-1	3
Pressure Saba: tourism opportunities	1	-1	-4
Coralita Saba: tourism opportunities	0	0	0

Protect Saba: tourism opportunities	3	-2	2
Important Saba: drinking water and renewable energy	0	5	5
Pressure Saba: drinking water and renewable energy	-4	4	-4
Coralita Saba: drinking water and renewable energy	-1	-2	-1
Protect Saba: drinking water and renewable energy	-1	3	3

Table 7. Ranks per statement for the factors resulting from the Saban Q sorts

3.5.1.1 Future-oriented nature conservation

This perspective contends that nature has an intrinsic value and should be safeguarded for the future; hence it is strongly protection-oriented, while having an optimistic view of the state of nature. In this perspective, nature's intrinsic value and value for future generations are considered to be very important and worthy of protection (scored +5 and +4). Concerns about a brain drain of young and talented Sabans surfaced in some of the interviews. The perspective strongly rejects any pressure, including Coralita's, on nature's medicinal and spiritual or religious value (both -5). The spiritual and religious value of nature is mostly seen as finding peace of mind. In general, this perspective does not believe that much pressure is being exerted on nature – not even on the aspects that it strongly feels should be protected, namely its intrinsic value and value for future generations. In line with this, Coralita does not raise much concern either, except slightly in relation to aesthetics and biodiversity (both +2). Given the perception that neither pressure nor threats are problematic, it is interesting that this is the most protection-oriented factor, with the highest ranks for protection overall. The values specifically deemed to need protecting are tourism, nature's intrinsic value and nature's value for future generations; they are considered important values, but not really under pressure. During the interviews, respondents often mentioned tourism as necessary, but only in a certain way. Large-scale formats with zip lines etcetera are deemed inappropriate for Saba. Values found to be unimportant, such as medicinal value or spiritual value, do not need to be protected. An explanation for the protection focus despite the optimistic view on the condition of nature could be that participants believe that the protection of intrinsic value and values for future generations requires the preventive protection of other values as well. And a protection focus may be inherent to the focus on future generations.

3.5.1.2 Modern utilitarian

This perspective stands out from the others in its articulate rejection of the spiritual or religious value of nature: it is not important, does not need to be protected, Coralita does not affect it, and it is not under pressure. Medicinal and recreational values are neither under pressure nor need to be protected. Instead, this perspective has a modern view of nature, emphasizing the utility value of nature: drinking water and renewable

energy provision are important (+5), under pressure (+4) and need to be protected (+3). Agriculture is also important (+4), and under pressure from, among others, Coralita, but interestingly enough is seen as not needing to be protected (0). All interviewees stressed the need for Sabans to take up agriculture again to supply themselves. They regard growing crops differently from keeping livestock; whereas crop growing is applauded, livestock are considered a menace, because free roaming goats damage nature and gardens. All interviewees also mentioned the need to involve future generations, expressing both disappointment in current youth and concern about the future available for them. Aesthetics is seen as important (+5) and the potential impact of Coralita is considered to be worrisome (+4). However, the interviews show that Coralita is seen both as enhancing and decreasing aesthetics. Next to aesthetics, Coralita raises worry regarding the supporting cycles of nature (+3). Yet despite acknowledging pressure on agriculture and aesthetics, interviewees with this perspective do not see protection as being a very important concern. This suggests they have a somewhat exploitative view of nature in which nature serves several purposes that are recognized as exerting pressure, but without resulting in interviewees being inclined to protect nature.

3.5.1.3 Optimistic agri-ruralism

This perspective is explicitly worried about Coralita's impact on agriculture (+5) and on biodiversity (+4), which are considered very important values of nature (both +4), although again a distinction is drawn between keeping livestock and growing crops. Utilities and supporting cycles need to be protected even though they are not under pressure. They are, however, important; a combination that also applies to intrinsic and touristic value. This perspective is the least concerned with pressure on nature, placing all pressure statements at the negative end of the continuum, particularly those concerned with aesthetics (-5), tourism (-4) and future generations (-3). However, in the interviews, the burning of garbage and diesel generators was mentioned as detrimental to the environment. Coralita is explicitly not considered to be a threat to recreational (-3) and scientific (-2) values of nature, since these values are not considered to be important. These are almost the only two values considered to be unimportant. This perspective is rather optimistic: nature is very important in many ways and under little pressure. Yet its adherents do have a clear view on the potential impacts of Coralita and feel quite strongly about protecting important values in a preventive way, whether or not they are under pressure.

3.5.2 Statian perspectives on the value of nature

In Statia we obtained 32 Q sorts, from which we drew a random sample, as discussed in section 3.4.3. This sample yielded three perspectives: *nature conservation for tourism, utilitarian scientists* and *bright future for community sustainability*. The titles are again

based on the discourses presented in Table 6. The ranks the participants attributed to the statements are shown in Table 8, organized by landscape value. In Table 8 we have abbreviated the statements as follows: "Important Statia: X" means "X is an important value of Statia's nature"; "Pressure Statia: X" means "X is under pressure on Statia"; "Coralita Statia: X" means "If Coralita would impact X, I would be worried"; "Protect Statia: X" means "We need to protect X on Statia". Tables 33-38 in the Appendix show the ranks per discursive element and per factor, and Table 39 the consensus statements.

Statement	Nat. cons.	Util. scient.	Comm.sust.
Important Statia: scenery, sounds and smells	2	3	0
Pressure Statia: scenery, sounds and smells	0	1	-3
Coralita Statia: scenery, sounds and smells	0	2	0
Protect Statia: scenery, sounds and smells	1	1	1
Important Statia: agriculture and livestock	-2	1	4
Pressure Statia: agriculture and livestock	-3	-2	0
Coralita Statia: agriculture and livestock	-1	0	1
Protect Statia: agriculture and livestock	-2	-1	3
Important Statia: variety of animals and plants	3	2	1
Pressure Statia: variety of animals and plants	2	-1	-2
Coralita Statia: variety of animals and plants	4	3	-1
Protect Statia: variety of animals and plants	4	3	0
Important Statia: future generations experiencing Statia	1	-2	4
Pressure Statia: future generations experiencing Statia	-1	-1	-2
Coralita Statia: future generations experiencing Statia	2	0	2
Protect Statia: future generations experiencing Statia	1	1	3
Important Statia: nature intrinsically	3	4	2
Pressure Statia: nature intrinsically	4	-5	0
Coralita Statia: nature intrinsically	2	-2	-1
Protect Statia: nature intrinsically	5	0	1
Important Statia: medicine	-2	-3	2
Pressure Statia: medicine	-5	0	-5
Coralita Statia: medicine	-1	-2	0
Protect Statia: medicine	-1	2	-3
Important Statia: recreation and unwinding	1	2	1
Pressure Statia: recreation and unwinding	-3	0	-4
Coralita Statia: recreation and unwinding	0	0	-5
Protect Statia: recreation and unwinding	1	1	-2
Important Statia: science and learning	-1	5	1
Pressure Statia: science and learning	-5	3	-3
Coralita Statia: science and learning	-2	1	-3

Protect Statia: science and learning	0	5	0
Important Statia: spiritual and religious	-4	-1	3
Pressure Statia: spiritual and religious	-4	-3	-2
Coralita Statia: spiritual and religious	-4	-4	-4
Protect Statia: spiritual and religious	-3	-5	3
Important Statia: clean air, water and soil	0	4	5
Pressure Statia: clean air, water and soil	-2	4	0
Coralita Statia: clean air, water and soil	3	0	-1
Protect Statia: clean air, water and soil	0	2	2
Important Statia: tourism opportunities	5	-4	2
Pressure Statia: tourism opportunities	-1	-3	-2
Coralita Statia: tourism opportunities	0	-4	-1
Protect Statia: tourism opportunities	3	-1	-1
Important Statia: drinking water and renewable energy	1	-2	4
Pressure Statia: drinking water and renewable energy	-3	-1	-4
Coralita Statia: drinking water and renewable energy	2	-3	-1
Protect Statia: drinking water and renewable energy	0	0	5

Table 8. Ranks per statement for the factors resulting from the Statian Q sorts

3.5.2.1 Nature conservation for tourism

This factor sees the intrinsic value of nature, as well as biodiversity, as being under pressure and therefore requiring protection. Coralita's potential impact on biodiversity and supporting services is worrisome. This perspective scores the importance of tourism conspicuously high (+5) and contends that it warrants protection. Nature thus seems to serve as a tourist attraction, and as neither recreation nor aesthetics score high, tourism for outsiders as a source of income seems most important. Any spiritual or religious value is strongly rejected by this factor, which scores very negatively on all four discursive elements. Pressure on nature scores rather low for most values, with the most negative scores assigned to pressure on medicinal and scientific values (both -5). Somewhat surprisingly, of the three perspectives this one is the most worried about Coralita's potential impacts. The worry focuses on biodiversity and the intrinsic value of nature, seeing both values in need of protection. This would suggest that in this perspective, protection is a prevention-oriented approach. Yet, supporting cycles and future generations are seen as only minimally important, not under pressure and scarcely worthy of protection. So, for these values the worry about Coralita is not accompanied by a desire to take preventive measures. In sum, this factor seems to have a rather optimistic view about the state of nature, and sees nature as a major tourist attraction and hence requiring protection.

3.5.2.2 Utilitarian scientists

This is the only factor on both islands for which science and learning scores very high in importance and is considered to be under pressure (both +5). Interviewees stressed the importance of science for understanding nature and knowing how to take care of it or use it properly. Local knowledge is seen as a kind of science as well. In addition, supporting cycles are seen as very important and under pressure (which the other factors do not think is the case), but do not score very high on protection (+2). More conspicuously, the intrinsic value of nature is very high (+4), but does not require protection (0), presumably due to the pressure on this value and potential impact of Coralita being perceived as low. Biodiversity does require protection, potential impact of Coralita on biodiversity raises worry, and this value is seen as somewhat important (+2). More important is aesthetics (+3), but given low pressure and Coralita-induced worry, no protection of this value is required. This perspective thus clearly sees protection as a measure for abating rather than preventing pressure. Tourism scores very low within this perspective, as do the spiritual and religious values. Interviewees indeed expressed a dislike of tourism as an economic sector for Statia, and a preference for science as a source of income. There is a scientific research station on the island, and some of the interviewees expressed the hope that this would attract an increasing influx of researchers, which would boost the economy. Coralita does not pose much worry in this perspective, except for its impact on biodiversity (+4). This perspective sees two clear uses for nature, one through the supporting cycles that enable life, and the other to contribute to science and learning.

3.5.2.3 Bright future for community sustainability

This is a perspective of extremes: it is the perspective that scores highest on importance and protection and lowest on pressure and Coralita-induced worry. The perspective appears to be very optimistic; nature is seen as important because of its supporting cycles, its significance for future generations, utilities and agriculture, and even for its spiritual dimension. Like their Saba counterparts, the Statian participants viewed free-ranging cattle as making livestock husbandry undesirable, as opposed to growing crops. This is the only perspective to attach importance to the spiritual and religious value and want it protected (both +3). This factor scores all the important values also high on protection, which suggests a preventive view of protection. Protection is seen as needed most to secure nature's value for utilities, future generations and agriculture and to ensure nature retains its spiritual value. The interviews reveal that the impact of Coralita on aesthetics is not clear-cut and elicited urgent calls to make Statia self-sufficient (again). No value is considered to be under pressure (all scores 0 or lower), and Coralita induces only slight worry for future generations' experience of Statia (+2), which is very important (+4). Conspicuously, this factor is the only factor that thinks the utility value of nature requires protection (+5), while rejecting the idea that the value is

under pressure (-4). Thus, this factor sees nature as being of great use to society in every way; utilitarian, via supporting cycles, utilities and agriculture, but also metaphysically for future generations, and spiritually.

3.6 DISCUSSION

3.6.1 Comparison of Statia and Saba

From the Q analysis we expected to find *hedonistic* and *natural conservation* perspectives on Saba, emphasizing the landscape values of tourism, aesthetics, relaxation and recreation, and biodiversity. On Statia we expected *agri-ruralist* and *utilitarian* perspectives, with agriculture and livestock, utilities and medicinal values of the landscape featuring most prominently. In Table 9 you find an overview of what we actually found. Before going into our findings, we would like to stress that our method did indeed bring differences between the islands to the fore. This is an important achievement, showing that the approach is capable of picking up nuances. What we found differed slightly from what we expected, though. Aesthetics do indeed feature prominently in one of the Saban perspectives, but not on Statia. Supporting cycles are important to two of the Statian factors, which fits with the utilitarian perspectives. Contrary to our expectations though, agriculture and livestock features prominently in two of Saba's perspectives but in only one of Statia's perspectives. Also unexpectedly, tourism does not feature prominently in any of the Saban perspectives, but does in one of the Statian perspectives. The unfavorable conditions for agriculture on Saba (steep slopes and land scarcity) could make people more aware of its importance. Or, Statians might see agriculture not as a value provided by nature, since the national parks and farms are quite far apart. Lastly, the negative sentiments regarding livestock may have prompted participants to score the agriculture cards low, which they indeed commented on frequently. Do these insights help us with participatory governance of IAS?

3.6.2 Eliciting latent problem perceptions with Q

The aim of this research was to develop and validate a method to ascertain stakeholder stances and thus deployed Q methodology to elicit latent problem perceptions, making stakeholders identifiable. We accrued four types of insights.

One type comprises very straightforward insights into views on hypothetical Coralita impacts, as elaborated on in Table 10. One Statian factor rated all Coralita-worry statements very low, while another factor would be very worried if Coralita were to impact biodiversity. This is however not where Q's strength lies, since other methods (e.g., a Likert-scale survey) could yield this data too.

Factor / Landscape value	Saba			Statia		
	Future-oriented nature conservation	Modern utilitarian	Optimistic agri-ruralist	Nature conservation for tourism	Utilitarian scientists	Bright future for community sustainability
Aesthetics	Important	Important; Coralita worry	No pressure			
Agriculture and livestock		Important	Important; Coralita worry			Important
Biodiversity			Important; Coralita worry	Coralita worry; Protect		
Future generations	Important; Protect		No protection			Pressure
Intrinsic	Important; Protect			Pressure; Protect	Important; Pressure	
Medicine	No pressure	No pressure	No pressure	No pressure		No pressure
Recreation and relaxation						No pressure; No Coralita worry
Science and learning				No pressure	Important; Protect	
Spiritual and religious	No pressure; No Coralita worry	No protection; Not important; No pressure; No Coralita worry		Not important; No pressure; No Coralita worry	No Coralita worry; No protection	No Coralita worry
Supporting cycles	No pressure				Important; pressure	Important
Tourism			No pressure	Important	Not important; No Coralita worry	
Utilities	No pressure	Important; Pressure	Important; No pressure			Important; Protect

Table 9. Overview of perspectives and most conspicuous ranks. We only show the scores of +/- 5 and 4. E.g., no pressure = -5/-4; pressure = +5/+4

The second type of insight is a clear merit of Q: the relative importance of values, both those that are substantive and those that are discursive. Regarding the discursive values, those that scored highest overall were about values being important, the lowest-scoring statements concerned values being under pressure; worry about Coralita scored moderately. Remembering that Q sorts reveal thoughts in a relative manner, this does not necessarily mean that stakeholders do not think nature is under pressure, only that it features less prominently in their thinking than nature's importance. When promoting Coralita management, an argument in terms of the importance of nature might resonate better with stakeholders than arguing that pressure on nature needs to be abated. In addition to the discursive aspects of thought, our approach also elicited substantive aspects that offer handles for Coralita management. For example, within the *nature conservation for tourism* perspective on Statia, protection of biodiversity and the intrinsic value of nature are called for, both of which are considered to be under pressure. Thus, if impact of Coralita on biodiversity can be demonstrated, these stakeholders would presumably support management. However, spiritual and religious statements all scored very low, so arguments linking Coralita to such considerations will not resonate with many.

As mentioned before, our approach proved capable of reflecting differences between contexts of the elicited perspectives, in this case revealing differences between Statia and Saba attributable to environmental and socio-economic differences between the islands. This makes it valuable for designing locally appropriate management approaches. However, all this assumes a rather straightforward link between people's perspectives on nature and their susceptibility to certain arguments relating to management measures. The exact relation between concepts such as perceptions, attitude and behavior is still a heavily debated topic in environmental science and invasive species literature alike. See for example Estévez et al. (2015), who present a tiered system of values, attitudes, risk perceptions and behavior. Shackleton et al. (2019) point out that we do not even really understand how perceptions come about, and make a first effort to remedy this. The relation between the stakeholder perceptions elicited and behavior or willingness to manage is outside the scope of this chapter but any management effort should definitely take these findings into account.

The third type of insight is into the structure of perspectives by looking at links between values. For example, within one perspective a high score for the importance of biodiversity is combined with attaching high importance to tourism, while in another perspective it is combined with attaching high importance to nature's intrinsic values. Two very different pictures emerge from that: one of biodiversity serving a tourism purpose and one of biodiversity being important per se. For the former, Coralita management would gain strength when somehow involving tourism, while for the latter, arguments around Coralita threatening biodiversity would resonate most. Also insightful

is relating discursive values, especially regarding protection. When an important value is not considered to be under pressure but is considered to need protection, it seems that protection is interpreted to mean prevention. This is very different from when an important value is considered to be under pressure but not to need protection.

Lastly, taking the deep understanding of the valuation of nature yielded by Q method combined with the different discursive elements, revealed potential (dis)agreement between perspectives. In Table 10 we indicate where overlap and dissonance can be found for both islands.

Perspective	Insight
Saba	*On Saba, two perspectives' support would be available in the case of impact on agriculture or on biodiversity. Aesthetics is also mentioned as a concern by two perspectives, but the ambiguous effect of Coralita on this value probably in practice limits the potential for agreement on what action should be taken. Two of the perspectives would support preventive measures.*
Future-oriented nature conservation	The only pressure on nature is on tourism, so Coralita impacting on tourism might garner their support. They would also be worried by an impact on aesthetics and biodiversity, so this could offer a hook for Coralita management.
Modern utilitarians	They see large pressure on nature, but are not very protection-oriented. They do assign a high score to potential worry about Coralita's impact on aesthetics, agriculture and supporting cycles. Should impact on any of these values be shown, then they would probably call for Coralita to be managed.
Optimistic agri-ruralists	They worry about the impact of Coralita on agriculture and biodiversity, so Coralita impacting on these might garner their support.
Statia	*Two perspectives share a concern for biodiversity, and two others for supporting cycles and the utility value of nature. Linking Coralita management to these values might resonate. The perspectives would probably not converge in relation to the spiritual and religious meaning of nature, or to its value to science and learning, which are found very important by one perspective, and explicitly not by the other two perspectives. Two of the perspectives would support preventive measures.*
Nature conservation for tourism	Coralita management would be supported if it were found to impact on biodiversity, or to be disliked by tourists, or simply because tackling it would help protect nature in general.
Utilitarian scientists	Protection is not seen as a preventive measure, so Coralita management would presumably only be supported if it were shown to negatively impact biodiversity, as biodiversity is seen as worth protecting.
Bright future for community sustainability	Coralita explicitly induces worry when considering future generations. Since this perspective finds nature's spiritual and religious value to be important too, Coralita management might be perceived as called for, given the responsibility to protect nature for future generations to ensure it can provide all its services to them as well. Also, impacts of Coralita on nature's utility value would probably resonate.

Table 10. Insights on Coralita management per island and perspective

Our approach certainly resulted in a lot of data, yet some questions arise that merit further investigation. For example, are some landscape values linked to others, such as aesthetics to recreation or tourism? And what use are supporting cycles if not to sup-

port other values? They were sometimes nevertheless rated highly without any other value being linked to them. By contrast, intrinsic value of nature was frequently scored highly, but together with other values. So, what does "intrinsic" mean in this case? These paradoxes might have to do with the landscape value typology, or with Q method itself, which assumes that participants have opinions that are arranged in a sequence that can be elicited through the Q sort. The forced nature of Q sorting might, however, also assume a thought-through arrangement where there is none. Prudence should therefore be exercised when interpreting a Q sort, so as not to "see" more than there is. Moreover, the understanding of perspectives as static identities is increasingly challenged, the argument being that it results in entrenched stakeholders (Turnhout et al. 2010) and perspectives should rather be understood as performative practices (Gonzalo-Turpin et al. 2008).

Another question still to be answered is who holds which perspective. The small number of participants and the statistics involved make the results from a Q study unsuitable for relating the participants' traits to the perspectives elicited. A follow-up study could use our results as the basis for a stakeholder analysis, to find out the prominence of the different perspectives and, for example, for analyzing the potential for conflict between perspectives (e.g., Brown and Reed 2012). And of course, some stakeholders might never want to participate in decision-making regarding Coralita, simply for lack of interest. Our method should not be seen as a way to change people's opinion or create problem perceptions where there are none. Stakeholders could be uninformed and therefore not engaged but might also simply not be interested in the topic at hand (Turnhout et al. 2010). Lastly, it is important to stress that our results do not argue for or against participatory governance. Attempts have been made to identify conditioning variables for successful participatory governance (e.g., Newig et al. 2018), and these could be assessed for Coralita on Saba and Statia to see if participatory governance would indeed be appropriate. However, we worked within the general belief in participatory governance literature that stakeholder involvement is beneficial (Lührs et al. 2018). This exercise has resulted in insights into problem perceptions that have so far been latent – particularly insights into the structure of people's perceptions. Understanding structures of thought is very important for stakeholder engagement in participatory governance; it has spawned interesting methods such as cognitive mapping (e.g., Moon and Adams 2016, Santo et al. 2017). However, such an approach would not work for the case where actors cannot articulate their perceptions because impacts of an ecosystem change are unknown. By combining Q methodology with a nature value typology as we have done, stakeholder perceptions can nevertheless be elicited, and stakeholder engagement be worked towards.

3.7 CONCLUSION

Although participation is no guarantee for socially and ecologically successful environmental governance, it is often applied and a large body of literature addresses its optimization. We found a gap in that literature when it comes to cases where problem perceptions are latent and stakeholders are therefore difficult to identify, which we worked on in this chapter. As such, we have reported on how we deployed Q methodology to elicit the latent problem perceptions of the inhabitants of Saba and Statia about the invasive alien plant Coralita. To enable participatory governance of ecosystem changes, stakeholders need to be identified, but that is hampered when no clear impacts on people's livelihoods are known. Our approach offers a way around that limitation by combining Q methodology with landscape values, and allowed us to identify three perspectives per island of which Table 9 gives an overview. On both islands, some of the perspectives are very nature-conservation oriented, seeing an intrinsic value in nature, wanting to protect biodiversity and worrying about the impact of Coralita. In addition, there are perspectives which see nature as providing economic services, such as drinking water, electricity or agriculture. Some of the perspectives see protection as a means of abating extant pressure, while others regard protection as a preventive measure. These are all valuable insights for facilitating participatory governance of this issue.

Quite comprehensive impressions are obtained thanks to Q methodology forcing participants to disclose the relative importance of aspects of their views. This is much more insightful than, for example, a Likert-scale survey in which a participant can assign every statement equal weight. Moreover, our approach proved capable of eliciting comprehensive insights into people's thinking about a topic that they have trouble articulating their views on. This is the merit of combining Q methodology, which forces people to express their views in a relative manner, with the landscape value typology. By addressing Coralita via potential impacts on nature, we circumvented the gap in knowledge on the vine's impact. Thus, we identified stakeholders' perceptions regarding Coralita management. This enables their participation in decision-making, and these insights can be taken into account in future research and policy exercises.

We think our approach is also applicable in similar cases where the articulation of perceptions about a change in an ecosystem is hampered because the impacts are not clear, but participation of stakeholders is nevertheless required. Future research can build on our insights by furthering our understanding of how to identify stakeholders in such cases, which in turn facilitates participatory governance of complex environmental challenges for which stakeholder involvement is key.

Chapter 4

Solving a problem they did not know they had. Tailoring participatory action research to deal with latent environmental problems: can Saba overcome the inertia?

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ABSTRACT

Participatory action research (PAR) is an approach for fully co-creating research into environmental problems with the public. We argue this is mostly done for manifest environmental problems that clearly threaten livelihoods and have highly predictable impacts. But the conventional PAR approach is not suitable when the impacts are poorly understood and pose a low threat to livelihoods. Such latent environmental problems do not have a clear conflict to be resolved; instead, the community's inertia should be overcome. In this chapter we develop what we call the PAR-L approach, for which we present a step-by-step guide and an evaluation framework. We then demonstrate this approach on the latent problem of the invasive alien Coralita vine on Saba and find that it results in thorough understanding of the community inertia. Overcoming the inertia would require a project to run longer and a simultaneous knowledge-gathering effort, but PAR-L is a good starting point.

4.1 INTRODUCTION

The involvement of local communities in the management of the environment is by now widely accepted as crucial to successful governance (Folke et al. 2005, Papadopoulos and Warin 2007, Armitage 2009, Turnhout et al. 2010, Lührs et al. 2018, Newig et al. 2018). Approaches for doing so abound, and one that is increasingly applied is participatory action research (PAR), in which research into how to manage an environmental problem is fully co-created and co-conducted with members of the public (Shirk 2012). This goes beyond citizens participating in specific research activities such as mapping (Hawthorne et al. 2015) or species monitoring (Dangles et al. 2010), as it involves locals in every step of the research. The knowledge created is used to inform action, with the aim of changing the day-to-day lives of a community (Reason and Bradbury 2001, Kindon et al. 2007, Kemmis et al. 2014, Reason and Canney 2015). It has been quite successful in achieving improvements to livelihoods by ameliorating tangible environmental problems such as the depletion of fish stocks (Apgar et al. 2017) or disputes about land-use (Valencia et al. 2012). PAR has fostered change by co-creating knowledge among stakeholders and researchers, strengthening social networks, opening up networks towards collaborative governance, and generating shared visions and compromises (Trimble and Berkes 2013, Trimble and Lázaro 2014, Apgar et al. 2017). Thus, PAR enables environmental problems to be addressed with the support and full involvement of a community. Nevertheless, there seems to be an absence of PAR studies of environmental management challenges with low impact on people's livelihoods. We contend that there is a suite of environmental problems characterized by high uncertainty and a low threat to livelihoods, for which conventional PAR approaches are not suitable. These latent environmental problems result in community inertia, since the community does not clearly experience a problem, and this makes PAR's focus on shared visions and compromises inapplicable. Yet the full involvement of a community as fostered through PAR may still be required: for example, if their cooperation is needed to implement the solution. In this chapter we therefore develop an alternative approach for conducting PAR, suitable for latent environmental problems. To that end, we first elaborate on latent environmental problems and the ensuing inertia, then outline the steps to conduct, and lastly present criteria for evaluating such a trajectory. These three elements are demonstrated on a latent environmental problem in the Caribbean Netherlands: the invasive alien Coralita vine.

4.2 TAILORING PAR TO LATENT ENVIRONMENTAL PROBLEMS

Participatory action research can be conducted in many different ways, but we argue extant approaches for doing so to be less suitable for latent environmental problems. Here

we elaborate on latent problems by presenting a typology based on the predictability and threat of impacts, and on the inertia they result in. Then, we present a step-by-step guide and an evaluation framework for PAR pertaining to such cases.

4.2.1 Latent problems and the inertia that ensues

We first introduce a typology of environmental problems, to illustrate the types of problem for which we think the conventional PAR approaches are not applicable, centered on the impacts on a community's livelihoods, and on the certainty that they will occur. Then, we look at how inertia may ensue, and why that poses an atypical challenge for PAR.

4.2.1.1 A typology of environmental problems

Several typologies have been developed to categorize environmental problems according to the type and degree of uncertainty involved. For example, De Boer et al. (2010) distinguish between uncertainty pertaining to cause and effect relations, and uncertainty regarding preferred outcomes. Inspired by, among others, Hisschemöller and Hoppe (1995), Hurlbert and Gupta (2015) propose a grid in which one axis represents agreement on values and norms, and the other represents agreement about the science. Van Enst et al. (2014) use the same distinction but call the axes consensus on relevant norms and values, and certainty of relevant knowledge. A general distinction we glean from these typologies is between uncertainties that are subjective (norms, values) and those that are objective (facts, science). Similarly, Gormley (1986) introduced the distinction between salience and complexity of issues, with salience defined as whether the public is interested in an issue. Building on the thinking about salience and normative aspects of environmental issues, we look at an issue's salience to communities, defined by the threat it poses to their livelihoods. This is placed on the horizontal axis in Figure 7, juxtaposed against the predictability of an environmental problem's impact on the vertical axis. Predictability depends firstly on knowledge and understanding of the processes involved, i.e., the factors at play and their interactions such as feedbacks. Secondly, it depends on their parametrization, i.e., the quantification of these impacts, which is a step further in uncertainty reduction and allows predictive models to be calibrated and validated. The greater the predictability of impacts, the easier it is to prevent or deal with them, but whether people are interested in making an effort to achieve this also depends on the threat posed to their livelihoods. Naturally, the threat of an environmental problem can differ across livelihoods; we use this grid only for a generalized and tentative categorization of environmental problems.

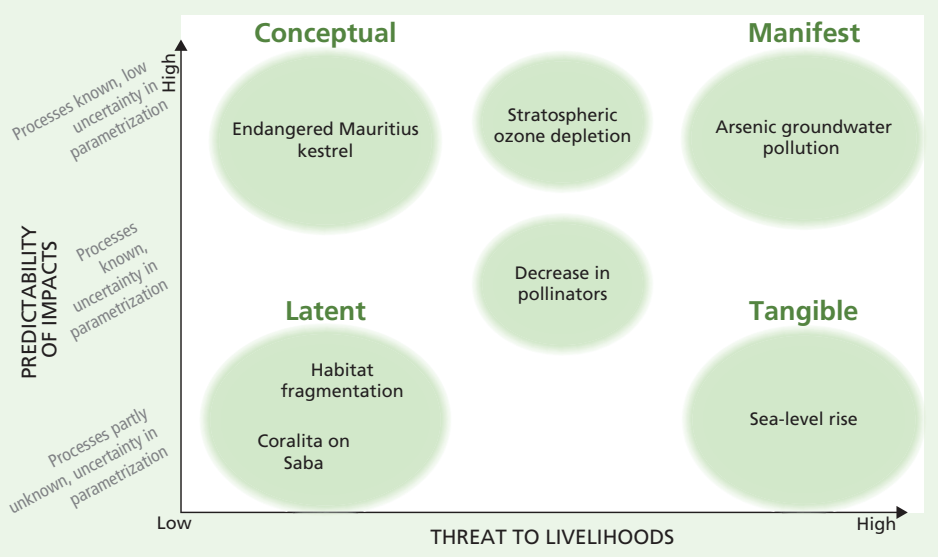


Figure 7. Typology of environmental challenges, according to threats posed to livelihoods and the predictability of impacts.

An example of a *manifest problem* is arsenic contamination of groundwater. The sources of contamination are well understood, as are the impacts on people via drinking water and accumulation in the soil and crops. The locations of pollution are well known, thus making the impacts very predictable (Rajmohan and Prathapar 2014). This is not the case for *tangible problems* such as sea-level rise, since apart from the generally accepted understanding that the increase in anthropogenic greenhouse gas emissions has accelerated sea-level rise, the exact processes are largely unknown. Generally, thermal expansion and the melting of glaciers and ice sheets are seen as resulting in global mean sea level rise (Le Bars 2018), but the models are highly complex and thus contested (Sriver et al. 2018). Making projections of local levels is beyond their capacity (Rasmussen et al. 2018). Conversely, for *conceptual problems* the impacts are highly predictable, but threats to livelihoods are minimal. An example is the near-extinction of the Mauritius kestrel (*Falco punctatus*). How predator pressure from invasive species such as mongoose and the spraying of DDT affect the population of kestrels is well understood (Cassimally 2010), but the impact of the species' decline on Mauritians' livelihood are zero. Environmental problems with an equally low threat to livelihoods but compounded by the low predictability of their impacts are what we call *latent problems*. An example of this is the fragmentation of habitats, which is argued to have a wide array of impacts, such as species' extinction (Benchimol and Peres 2014), disturbance of pollination dynamics (Hadley and Betts 2012) and evolutionary adjustment in reproductive traits of plants (Jacquemyn et al. 2012). However, none of these impacts, let alone their

cumulative effect on an ecosystem scale, is fully understood (Ewers and Didham 2006). Another example is the invasive alien Coralita vine (*Antigonon leptopus*) on Saba, whose spread and impacts are poorly understood and whose threats are mainly ecological. This case is more elaborately discussed in section 4.3, as we use it to demonstrate our adjustments to PAR.

These four quadrants should be understood as heuristic categories for which in reality many hybrids exist. Stratospheric ozone depletion is one such example: the chemical process is very straightforward, captured by a formula of ozone-depleting substances (hydrocarbons) after photodissociation in the stratosphere releases halogen atoms that break down ozone into oxygen. Both the amount of ozone-depleting substances and the size of the hole in the ozone layer are easily and closely monitored (Lovelock 1977, Grundmann 2018). While the potential health impacts are severe, the threat to livelihoods is lower than for sea-level rise or arsenic groundwater contamination. Similar in its threat to livelihoods, but with less predictable impacts, is the decline of pollinators. We know how important pollination is for crop production and have a reasonable understanding of the processes that result in pollinator decline. Pesticides and pathogens are infamous culprits, as is habitat decline. The exact impacts of rising temperatures due to climate change on populations are less well known, but the main barrier to full understanding of pollinator decline is a shortage of long-term and geographically spread data (Jarvis 2018, Rhodes 2018). Thus, the processes are well known, but parametrization is not yet feasible.

PAR generally focusses on manifest problems, implying conflicts that need to be resolved. For example, in the village of Cinquera in El Salvador, PAR addressed conflicting claims to land used for agriculture by former civil war combatants and the severely impoverished villagers (Valencia et al. 2012). In the Barotse Floodplain of Zambia, PAR addressed an aquatic agricultural system on which both fishermen and government depend for their income (Apgar et al. 2017). In Uruguay, PAR addressed declining fish stocks in coastal areas, on which the local communities fully depend for their livelihood (Trimble and Berkes 2015). Through PAR, trust between stakeholders has been enhanced, reflective dialogue among them promoted, shared visions developed and compromise reached (Trimble and Berkes 2013, Trimble and Lázaro 2014, Apgar et al. 2017). But whereas manifest problems come with conflicting stakes that matter to a community, latent environmental problems are characterized by a community's inertia in dealing with them, as discussed in the next section.

4.2.1.2 Community inertia

The purpose of PAR is to resolve problems that affect people's day-to-day lives, by generating knowledge and informing action (Kemmis et al. 2014, Bradbury 2015). Thus, PAR projects select the problem to focus on jointly with the community (Bacon et al. 2013).

However, in the case of latency, the community does not really experience a problem and is inert because of the uncertainties and low impact of the phenomenon. Inertia occurs when, among other factors, the costs of acting are high and not acting becomes rational in the face of large uncertainties (Munck af Rosenschöld et al. 2014). Acting on e.g., habitat fragmentation would entail large costs for a community, such as changing their land-use and creating ecological corridors. Given the uncertainties involved and the lack of threat to their livelihoods, inertia on the part of a community is understandable. This differs from diametrically opposed opinions resulting in an impasse (sensu Biesbroek et al. 2014) or gridlock (sensu Jones and Baumgartner 2012). Nor is it a non-decision, where a community knows that existing authorities, powers and values will keep them from addressing the issue (Bachrach and Baratz 1963). Rather, a community's inertia is similar to Munck af Rosenschöld et al.'s institutional inertia, which they employ to explain the lagging responses to climate change: "Institutional inertia refers to the 'stickiness' (Pierson 2004, p.8) of institutions, or to how they resist change." (Munck af Rosenschöld et al. 2014, 640).

We conceptualize community inertia as resulting from an aggregate of a community's practices in which sticking points prevent change from happening. A community can refrain from acting for many reasons, such as lack of faith in others' cooperation (Niemiec et al. 2016), tension around responsibilities and obligations (Head and Atchison 2015) or differences in prioritization (Tauro et al. 2018). In this chapter we focus on the practices in which Coralita is embedded on Saba. Practices are purposeful arrangements of people relating to sayings and doings, such as land-use or harvesting, and are a common unit of analysis in PAR (Kemmis et al. 2014). While practices themselves are purposeful, they can have corollary effects on, for example, a latent problem. We use the sticking point typology as presented succinctly by Waylen et al. (2015) to analyze elements of practices that keep a community inert regarding a latent environmental problem. Sticking points are a type of legacy effect that explain resistance to change, or why only incremental change is achieved. The term is similar to 'lock-in', 'pathway' or 'gridlock', but leaves open in what way change is resisted. Waylen et al. (2015) distinguish three types of sticking point: (1) institutional, which are the (in)formal rules and norms arising from previous ways of working; (2) cognitive, arising from ways of framing and knowing; and (3) political, which are sticking points arising from extant power relations and interests. The aggregate of practices explains why an environmental problem manifests itself the way it does in a given community. Next to that, it is necessary to map the practices and sticking points from which – intentionally or otherwise – inertia regarding a latent problem ensues, so improvements can be envisioned and implemented with a community. These changes should mean improvements for the community, while also adjusting practices such that the latent problem is positively affected; below, we outline a stepwise approach for achieving this.

4.2.2 From PAR to PAR-L: step-by-step guide and evaluation framework

The community inertia described above is the main challenge to be dealt with in the case of latent problems, instead of a manifest's problem contradicting stakes. Yet PAR's aim to co-produce a solution with a community can be argued to be preferable for manifest and latent problems alike because it increases the democratic value, because locals have important insights, or because compliance is likely higher among those who have been involved (Bulkeley and Mol 2003, Koontz and Thomas 2006, Glucker et al. 2013). Therefore, we propose an adjusted approach for conducting PAR, which we name "PAR-L", with the L referring to the latent problems it is intended to address. The approach comprises a step-by-step guide to conducting PAR-L, and an evaluation framework to reflect on its success.

4.2.2.1 A step-by-step guide to PAR-L

PAR-L's aim is to work together with a community to jointly develop improvements to that community's practices that both benefit their day-to-day lives and address the latent problem affected by these practices. We outline seven steps for doing so, which are based on the conventional approaches to PAR (such as Ballard and Belsky 2010, Shirk 2012, Bacon et al. 2013, Trimble and Berkes 2013, Kemmis et al. 2014, Apgar et al. 2017). In essence, five stages are gone through: defining the issue, planning, acting, observing and reflecting (as presented by Apgar et al. 2017). The process is iterative, so in the reflection phase it can be decided to start a new cycle, or during project implementation it can be decided to return to an earlier phase. The shape PAR trajectories take is highly unpredictable, since they are co-produced with the local community. Thus, the research approach and implementation procedure are chosen in accordance with the project aim that is selected. PAR trajectories should respond to a community's needs and advancements in understanding (Coughlan and Coghlan 2002). They start with researchers becoming or being made aware of an issue at stake in a certain community, which prompts them to start PAR. The problem is defined together with stakeholders, which forms the basis for drawing up a plan for researching or critically assessing related practices (Bacon et al. 2013, Kemmis et al. 2014, Trimble and Lázaro 2014). Then a project is implemented to solve the issue and, based on a joint evaluation of the improvements made, a new cycle can be started. These steps are listed in the left-hand column of Table 11 together with an indication of why they need to be adjusted for PAR-L; the results of the adjustments are shown in the right-hand column. In step 2, the researchers gather an overview of practices and sticking points, which as the project progresses, may be added to. In step 3, the researchers and community jointly envision improvements to these practices and sticking points that benefit the community's livelihoods while also positively affecting the latent environmental problem. These changes are then to be implemented in the subsequent steps, thereby overcoming the community inertia regarding the latent problem and concomitantly improving the community's livelihoods. In the last step, the changes are evaluated, using the framework presented in the next section.

	PAR step	Reason for adjustments	Proposed PAR-L step
1	Researchers hear about a problem a community is experiencing	A latent problem implies that a community is not experiencing a problem	Researchers approach a community about a latent problem
2	The community's practices concerning that problem are explored	The focus is on inertia rather than a problem, so we should look for sticking points within the practices	The community's practices and sticking points adding to the inertia regarding the latent problem are explored
3	A research aim is formulated to address the problem	Due to problem perceptions being latent, the community will not see a clear research aim	Possible improvements to the practices and sticking points are envisioned jointly with community
4	A project is designed, to attain the research aim	The focus is on the improvements envisioned with the community	A project is designed in order to achieve the improvements
5	The project is implemented and its implementation is documented	No adjustments needed	The project is implemented and its effects are documented
6	The findings are disseminated and discussed	No adjustments needed	The findings are disseminated and discussed
7	The project is reflected on	No adjustments needed	The project is reflected on

Table 11. Steps proposed for PAR-L based on adjustments made to conventional PAR approaches

4.2.2.2 Evaluation scheme for PAR-L

A PAR-L trajectory aims at overcoming community inertia regarding a latent environmental problem by implementing changes to practices and sticking points co-developed with the community. These changes should both improve the community's livelihood and positively impact the latent problem. We adjusted two PAR evaluation schemes to fit the PAR-L aim, presented by Trimble and Lázaro (2014) and Kraaijvanger et al. (2016). We added criteria regarding the upscaling potential of the project, the envisioning of an improved situation by participants, and understanding and overcoming the community inertia; this resulted in 15 evaluation criteria for a PAR-L trajectory. These criteria are listed and operationalized in Table 12, for application in the reflection in step 7, which informs the decision on how to proceed.

Evaluation criteria for PAR-L	Operationalization
Process criteria	
Envisioning of improvements to practices and sticking points	The participants were able to jointly envision changes to practices and sticking points that would improve their livelihoods and positively affect the latent problem.
Representativeness of participants	Participants feel the breadth of local views was represented in the team.
Full co-production	Participants were involved in the entire PAR-L trajectory.
Facilitation fosters inclusiveness and power balance	Participants feel their views were equally important and represented.

Collective decision-making through deliberation	Participants feel decisions were made by them all, together.
Knowledge and views are accessible to, and known by, all participants	Participants feel they were aware of everyone's views and knowledge, and of decisions made.
Adaptability through iterative research cycles	The project could be adapted while ongoing, or new cycles started.
Outcome criteria	
Cost-effectiveness of the project	The ratio of investments required from participants to the improvements they experienced.
Social learning and knowledge co-produced	Participants learned from each other and produced knowledge together.
Legitimacy of the project	Participants feel the project was legitimate.
Improvements to livelihoods	Participants think the project has resulted in improving their day-to-day lives.
Improvements to latent problem	The researchers think the project positively affected the latent environmental problem.
Impact criteria	
Upscale potential of the project	Are there any possibilities and plans for upscaling the project?
Understanding of the inertia	Were the researchers able to identify the relevant practices and sticking points resulting in community inertia?
Overcoming the inertia	Were the researchers able to change anything about the community inertia?

Table 12. Evaluation criteria for a PAR-L trajectory

4.3 DEMONSTRATION OF PAR-L THROUGH APPLICATION ON CORALITA ON SABA

Having elaborated on how to conduct and evaluate PAR-L, we now demonstrate its merit for application to a latent environmental problem, namely the invasive alien Coralita vine that covers large stretches of land on the island of Saba in the Caribbean Netherlands. Saba is the northernmost volcanic island in the active arc of the Lesser Antilles, with a terrestrial surface of 13 km^2 and 2,010 inhabitants in 2016 (de Freitas et al. 2016, CBS 2017). Saba has been part of the Caribbean Netherlands and a special municipality of the Netherlands since 2010. Hence, nature management responsibilities are held both by ministries in The Hague and local Saba government (Vaas et al. 2017). But up until now there has been a lack of policy and of concerted control efforts, and there are no apparent stakeholder groups regarding Coralita (Vaas et al. 2017, Vaas et al. 2019). Ecologists claim Coralita poses an enormous risk to biodiversity, but understanding of the processes in play is largely lacking and there do not appear to be any threats to people's livelihoods (Jongman et al. 2010, Smith et al. 2014, Sweeney 2018). It has been documented that Coralita rapidly covers vast areas and is very tough to remove due to its tuberous roots (Burke and diTommaso 2011), which is why it is a threat to

native flora and fauna, including the endangered iguana (van der Burg et al. 2012). Thus, the predictability of the vine's impacts is low. As is the threat it poses to livelihoods: it is a nuisance in yards, and locals generally dislike the vine (Vaas et al. 2017, Vaas et al. 2019). There are a few farmers on Saba, but the scale of agriculture is very limited (CBS 2017, Ministerie van BZK 2018). Thus, for the large majority of Sabans, Coralita poses no threat to their livelihoods, and there is little incentive to make the huge effort removal of the vine requires.

This is problematic, since invasive alien species (IAS) can have disastrous effects, especially on islands (Russell et al. 2017). Moreover, involvement of stakeholders is crucial, due to the need for full participation for successful management of IAS (Stokes et al. 2006, Verbrugge et al. 2013, Niemiec et al. 2016). Involvement of the Saban community is even more important because 90% of land is privately owned and there are no spatial planning ordinances (Schoenmaeckers 2010). Coralita on Saba is thus a good case of a latent problem for demonstrating the potential of PAR-L, and the small scale of the community makes it an expedient setting. While it means a lower absolute number of interviewees and participants, it also results in a highly representative sample: small numbers of participants do not preclude impact, as long as the participants are representative (see Ens et al. 2016). In the following, we recount the methods employed in the demonstration case.

4.3.1 Methods used in this demonstration case

Our trajectory, which ran from December 2017 to June 2018, employed different methods that were partially decided on in advance but mainly chosen during the process. In Table 13 a brief overview of activities per step and methods employed is given, and a detailed project description can be found in the Appendix.

Project step		Method or tool applied
Step 1	The authors became aware of Coralita on Saba, and started a PAR-L trajectory.	This was described in the first two paragraphs of section 4.3.
Step 2	The first author scouted areas covered in Coralita where alternatives could be tried out, and asked Sabans to indicate areas where they are most weary of Coralita. The practices and sticking points at play regarding Coralita were elicited through interviews. A survey measured the experienced "invincibility of Coralita".	Guided tours; interviews; PPGIS; survey
Step 3	A public evening was organized to envision improvements to practices and sticking points, where more local agriculture received much support. Hence, a project to replace Coralita with fruit trees was decided upon and a core team of seven Sabans was established.	Focus group
Step 4	Jointly with the local government and some agriculture-practicing citizens, planting lemon trees on a Coralita-covered area in St. John's was decided upon by the core team.	Guided tours

Step 5	With help from local children, Coralita was removed from the project area. Five lemon trees were planted, which were watered and kept free from Coralita by one of the core team members.	Interviews and participant observation
Step 6	A public meeting and a closed meeting with the core team was held to discuss the experiences with the lemon trees. The core team members were surveyed again on the experienced "invincibility of Coralita".	Focus group; survey
Step 7	During the focus group of step 6 and interviews with the individual core team members, the project with the lemon trees, as well as the full PAR-L trajectory was reflected upon.	Focus group; interviews

Table 13. Activities and methods used per step of the demonstration case

4.3.1.1 Guided tours

During steps 2 and 4 we needed information that is only available to locals: for example, the boundaries of properties and the historic uses of land. Guided tours allow locals and researchers to exchange such information, which is not otherwise obtainable (Berbés-Blázquez 2011). Accompanied by one or several locals, the first author visited an area and discussed the boundaries, land-use, ownership disputes and visions for future developments. The tours generally lasted an hour. We used these tours to find a project area, and to make planting designs for a project.

4.3.1.2 Interviews and focus groups

Semi-structured interviews were conducted during steps 2, 5 and 7. In steps 2 and 5, the interviews served to explore practices and sticking points regarding Coralita. We complemented this data with insights from interviews conducted earlier (Vaas et al. 2017). During implementation of the project, step 5, we frequently met briefly with the core team to discuss progress. The interviews in step 7 served to evaluate the project, using the criteria in Table 12; we thought the privacy of an interview would elicit franker answers (see Table 40 in the Appendix for an overview). As well as interviews, we conducted focus group sessions with the core team assembled in step 3. These served for discussing and creating understanding of the views of others, for co-creating knowledge and collectively interpreting experiences (Cameron 2010, Ingram et al. 2015). Thus, two focus group sessions were held; one during step 4 and one combining steps 6 and 7. The interviews and focus groups were audio recorded and transcribed, and analyzed in NVivo 11.4.1. We coded according to a grounded theory approach, starting with open coding, followed by axial coding and, finally, closed coding (Kock 2004). Additionally, we coded deductively for the variables in Table 12, as well as for the practices and sticking points identified.

4.3.1.3 Survey

We administered a small-scale questionnaire on the perceived invincibility of Coralita; the set-up and results can be found in the Appendix. It was filled out by the core team members before and after the project (steps 2 and 6), and by a control group of 43 Sabans during step 2. This increased our understanding of the cognitive sticking point that Coralita is invincible, and gave an indication of whether the PAR-L project changed that sticking point.

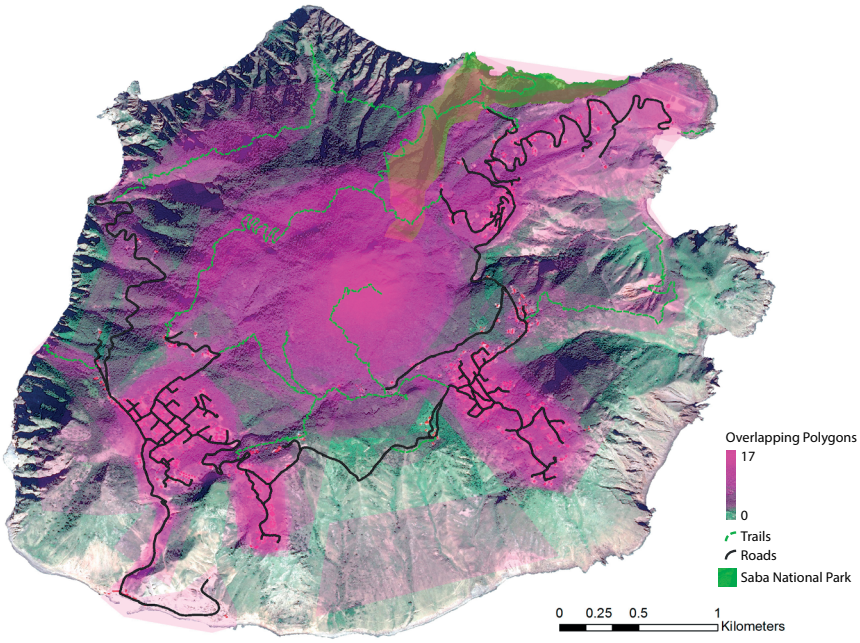


Figure 8. Where Coralita is unwanted on Saba, indicated by the pink areas. The brighter the pink, the more people (maximum of 17) indicated that area as preferably Coralita-free

4.3.1.4 Public participatory GIS

During step 2 we employed, jointly with researcher Elizabeth Haber, public participatory GIS (PPGIS) to give some spatial context to the Coralita issue. PPGIS is used to gather information on individual or community experiences of ecosystem services, to research ecological and social values in tandem, or to evaluate the compatibility of different projected uses of an area (see Alessa et al. 2008, Brown, Greg and Fagerholm 2015, Ramirez-Gomez et al. 2016). We used it to find out if there are areas where people are more annoyed by the vine. Fifty Sabans delineated up to five areas each, guided by the question "Where do you not want Coralita?", regardless of whether the vine was already present or not. The drawing was done on a tablet using ESRI's ArcGis Collector App and the resulting drawings were collated in ArcMap; the result is Figure 8 below.

Additionally, we undertook a small mapping exercise regarding fences and the presence of Coralita, to tentatively test a dynamic we observed. To that end, we walked one village and mapped all the intact fences and walls that could realistically be assumed to keep out goats. For each area we indicated whether Coralita was present there; the result is presented in Figure 30 in the Appendix.

4.3.2 Steps 1 – 6 of the demonstration case

A detailed description of the full PAR-L trajectory on Saba can be found in the Appendix. Here we briefly discuss the main points, which are evaluated in the next section. We started with exploratory interviews to gauge interest in setting up a Coralita-related project and to explore practices affecting Coralita. Based on that analysis, a project in which Coralita was replaced with fruit trees was decided on with the core team, as we will explain after discussing the three main practices relating to goats, land-use and land titles.

4.3.2.1 Free-roaming goats

Free-roaming goats are a persistent issue on Saba, despite the island ordinance that requires animals to be fenced in and tagged (Saba Government 2004). Two "goat buy-back" programs have been conducted on Saba and in each village a hunter holds a permit to shoot free-roaming goats (Ministerie van EZ 2017, DCNA 2017). Accounts of whether this actually happens are contradictory, but informants agree that even in the food-scarce period after the hurricanes of September 2017, no goats were eaten. This refutes the argument from interviewees that goats are a standby for hard times. The damage these animals do to nature and gardens is, however, severe. One calculation suggests that each year 1.8% of the total area of healthy land becomes degraded habitat due to goats (van der Lely et al. 2014, 20). In our project area, a fence was pushed over and one of the trees half-eaten. The offending goats are owned by the brother of a prominent politician and core team member, who in the evaluation interviews revealed the difficulty he had in getting his brother to comply with the island ordinance. *Political stickiness* is at play here: a political actor does not have the influence to confront goat owners. That the self-sufficiency from the past is invoked as a reason for keeping goats and that they are still regarded as a standby for hungry times jointly form a *cognitive sticking point*. For Coralita management, properties will have to be fenced to keep out feral goats, resulting in a major cost to farmers, as we discuss in the next section.

4.3.2.2 Limited agricultural activity

The Saban government's Department of Agriculture provides farmers with free fencing and water tanks, and our project area received these resources too. However, only fulltime farmers are eligible, not people growing a few vegetables in their backyard.

For these people, fences and water are costly and gardening is an expense rather than a profit, forming an *institutional sticking point*. The core team also pointed out the *cognitive sticking point* of the lack of appeal of agriculture: it is not a profession people aspire to anymore, and not having to work the land but buying food in a grocery store is considered a luxurious lifestyle. The core team member looking after the lemon trees was retired and farming on a small scale. Due to these two sticking points, most people consider the efforts and expenses required for transforming large stretches of Coralita land to be too high. And indeed, gardens with an intact fence are Coralita-free (see Figure 30 in the Appendix), since the owners have plans for their garden that warrant the expense. For them, Coralita is more of a tangible problem than a latent problem. A *cognitive sticking point* is Coralita widely being regarded as invincible, which adds to people's reluctance to gardening. We conducted a survey among the core team to quantify this sticking point, and gauge whether the PAR-L trajectory changed anything. The findings, discussed in Table 14, show that people became more convinced of the vine's invincibility, but also of the need to control it. One core team member also pointed out different views of what a yard should look like: land overgrown by a weed is not problematic to everyone. In addition, land titles are often an impediment to using land, as we discuss in the next section.

4.3.2.3 Large stretches of unused land

The property rights of one of the possible project areas were contested, which is a common phenomenon on Saba. Many properties are not officially registered in the cadaster, but vernacular knowledge on which family owns which area is widespread. In the past, land titles were not always registered correctly, and incomplete records of inhabitants make it impossible to reconstruct ownership properly (Franklin 2015). When the original owner died, the heirs were generally not registered as the new proprietors, resulting in a phenomenon known as "undivided property" (de Kort 2009). In day-to-day reality, the informal ownership is respected by government institutions as if it were legal (Hof van Justitie 2018). Difficulties arise, however, when contradicting claims to land are made, and legally unsound deed transfers make it hard to adjudicate such conflicts. According to Dutch law, land on Saba for which the titles and deeds are not in order belongs to the island government. However, this is rarely enforced and the government does not engage in any type of spatial planning (Hof van Justitie 2018). This is an *institutional sticking* point: historical claims to land are informal rules abided by in the present, compounded by a *political sticking point*, of political actors not wanting to change that practice for fear of voters' backlash. Core team members confirmed the delicate nature of land titles and gave examples of how this practice hampers the establishment of nature areas, or the practicing of agriculture. Lastly, they mentioned a *cognitive sticking point*: land is considered an asset and an investment for the future that does not need to be put to

use at this moment. These areas provide space for the goats to roam, where they find their food and Coralita can spread freely, which makes agriculture even less attractive.

Together, the free-roaming goats, unused land and limited agricultural activity result in large stretches of unused land where Coralita is free to grow and increase its potential to spread (see Figure 9). Sticking points such as a lack of law enforcement, historical land claims and costs of fencing make the community inert regarding this phenomenon. We selected the town of St. John's as our project area, based on a map of the areas where people do not want Coralita (see Figure 8), the presence of Coralita and the availability of a project plot. At a public brainstorming evening, the participants were mainly interested in enhancing agriculture so as to achieve cheaper and better-quality food – an approach which would also help contain Coralita. A core team of seven was established, and jointly with the first author they envisioned a fruit orchard as an attractive alternative for a Coralita-infested plot. Using input from them, the Department of Agriculture and local farmers, a design was made for an area made available by a member of the core team. Students in an after-school care program mowed the Coralita in an attempt to eradicate it from the area, and the Department of Agriculture assisted with the planting and fencing-off of five lemon trees. The fences were reinforced once, but despite this, one was pushed over and one tree was half-eaten. The trees were watered daily by one of the core team members, using water from a cistern on the land, which was filled by the government. Two weeks after planting, Coralita had already appeared next to the lemon trees. It was removed by the first author, and thereafter was only removed from inside the fences by the core team member watering the trees. During another public evening the end of May the experiences with the lemon trees were discussed, such as the restraints posed by the need for water and the costs of fencing. Ideas were raised for follow-up research into removal methods and the exact impacts of the vine, as well as arrangements to fund larger-scale land conversion. Due to time and resource constraints, these ideas could not be put into practice in a new PAR-L cycle. Interviews with the core team members were conducted as well, to evaluate the trajectory; the results are presented in the next section.

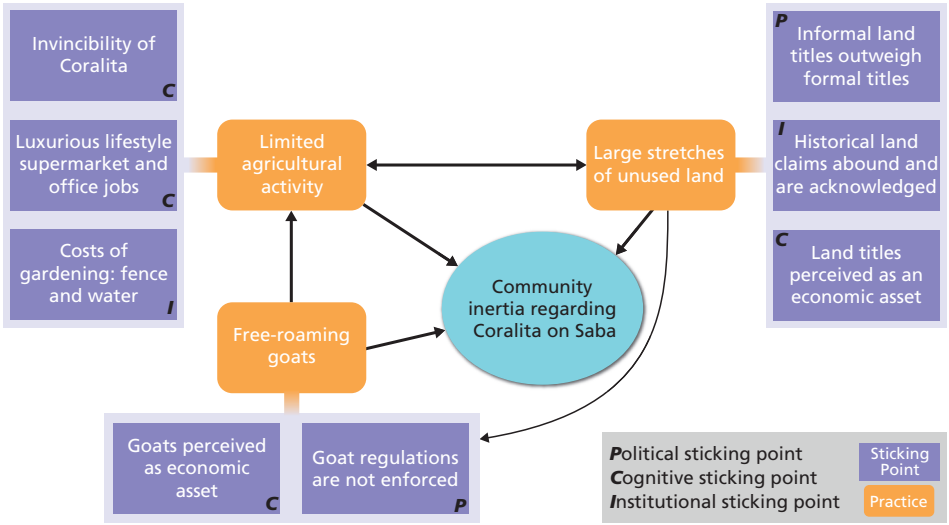


Figure 9. Practices and sticking points that generate community inertia regarding Coralita on Saba

4.3.3 Step 7 of the demonstration case: reflection and evaluation

The evaluation of the demonstration case is presented in Table 14. Three aspects stand out: 1) ownership of the project was rather low, which does not fit the co-production character of PAR projects; 2) adjustments were made during the project, but no new cycles were started; and 3) participants were positively surprised by the involvement of locals with the project. In the Conclusion and discussion, we reflect on the project's overall impact.

Evaluation criteria for PAR-L	Results in the Saba demonstration case
Process criteria	
Envisioning improvements to practices and sticking points	The brainstorming evening attracted a good number of attendees, who jointly formulated a vision of a better situation regarding PAR and decided on a pilot project.
Representativeness of participants	Participants stressed the difficulty of starting a social movement on Saba, and we did indeed invest much time in approaching people personally to get them involved. Participants were content about the actors involved, one explicitly praising the amount of local Sabans involved. Another stated several times that bringing a community together like this sets a good example. Youth and people living directly around the project area were mentioned as persons who could have been involved more.
Full co-production	Core team members were involved in every step, but in step 5 only one of them provided regular support. Interviewees indicated they had enjoyed the process but also admitted to being less active than they had planned to. They indicated that the facilitator could have given them more tasks.

Facilitation fosters inclusiveness and power balance	One participant commented on this, asserting that the research team approaching potential participants personally and spending much time talking with them fostered their involvement and willingness to participate.
Collective decision-making through deliberation	Two participants indicated that the course of the trajectory had not been decided by them; the others seemed neutral about this element.
Knowledge and views are accessible to and known by all participants	Participants indicated they felt they had been kept up to date well.
Adaptability through iterative research cycles	Adaptions were made during the project: for example, deciding very early to go ahead with one area, given the high costs of fencing for the other area. The planting design was adjusted according to plans for a playground. The availability of plants on the island guided the decision about what to plant, and the costs of fencing resulted in the planting of a few trees and no larger areas with vegetables, etc. But no iteration took place.
Outcome criteria	
Cost-effectiveness of the project	A one-off investment of 150 USD and 8 hours was made, for which we provide a breakdown in the Appendix. This gave us a good idea of the potential for upscaling the pilot; as the interviewees did not make any negative statements about the costs involved, this project was cost-effective. However, these costs were mentioned as a limiting factor for upscaling the project.
Social learning and knowledge co-produced	Participants mentioned two topics from which they learned. One related to organizing a project like this: a participant explicitly stated that much patience is required. Also mentioned was the challenge of getting Sabans together and jointly addressing an issue. The second topic mentioned was learning a bit about Coralita, and how it can be managed by investing some effort. Also, every participant mentioned meeting new people or speaking properly with people they had previously only known by sight. One interviewee was especially happy about working with so many locals.
Legitimacy of the project	All participants were used to outsiders starting projects on Saba, and all locals indicated that they saw this as an opportunity for both parties to benefit. One expressed disappointment that no Sabans were setting this up, and felt a chance was being missed by the Saban community.
Improvements to livelihoods	Half the core team members were explicitly enthusiastic about the attention drawn to agriculture due to the project; the others were mostly concerned with how to continue the project. They stressed the limitation of time as a resource, and the lack of the project's importance for Sabans.
Improvements to latent problem	Coralita was kept away from the trees, which means that on a very small scale some impact was had on the spread of the vine. As for the impact on Coralita, most of the core team members therefore felt this pilot made little difference. One member stressed that at least the area at the base of each tree had been kept Coralita-free, and when scaled up that could be a significant area.
Impact criteria	
Upscale potential of the project	There is definitely potential for upscaling, since the core team felt Sabans should start more of these pilots. However, there were no concrete plans.

Understanding of the inertia	The authors obtained a very thorough understanding of the practices and sticking points resulting in community inertia regarding Coralita as discussed in section 4.3.2. Experiencing some of them (e.g. dislike of agriculture, contested land titles) elicited topics to explore further, such as the land rights issue, which plays a much larger role than initially expected. Moreover, this topic appears to be only indirectly related to Coralita so may never have surfaced in interviews. In addition, links between elements and how they reinforce each other became clear. For example, the goats make fencing necessary, but fencing is very expensive, which in turn enhances the lack of land-use. Also important is the confidence generated by engaging in a project together with community members. We believe that in a conventional interview setting it would have been less likely for the politician to divulge disagreement with a family member, or for a core team member to point out weaknesses of the community to an outsider.
Overcoming the inertia	The survey on the cognitive sticking point of invincibility of Coralita revealed some small changes between scores before and after the project (see Appendix). For example, post-project all core team members disagreed with the statement "If you have Coralita in your yard, it's impossible to remove", whereas pre-project half of them agreed. Before the project, half the respondents were undecided about the statement "Saba is incapable of dealing with Coralita"; after the project, half agreed and half disagreed. The same undecidedness existed pre-project for the statement "I do not have a good reason to remove Coralita from my land" but had also disappeared post-project. This survey is very small scale and tentative, but the moderately positive results were confirmed in evaluation interviews with the core team. Although the number of participants was not very large, the interviewees thought it was a good score by Saban standards. In addition, they saw an important contribution in attracting attention to agriculture and land-use. The pilot adjusted these practices on the scale of our small plot, but it did not engender a breakthrough on a larger scale. Had the PAR-L project run longer, larger-scale changes might have been achieved if more plots and people had been involved.

Table 14. Evaluation of the demonstration case

4.4 CONCLUSION AND DISCUSSION

We started this chapter by pointing out a limitation of conventional PAR approaches when it comes to dealing with latent environmental problems, since it is centered around a community's wish to improve their day-to-day lives. We therefore developed an alternative approach (PAR-L), comprising a step-by-step guide and an evaluation framework. Within the demonstration case both worked well, but some improvements could be made. Analyzing sticking points and practices as a second step was useful, but the graphic depiction may suggest a degree of organization that does not exist in reality: the costs of gardening affect both agricultural and goat-related practices, and of course affect each other too. Also, the last two steps happened simultaneously, as it is hard to separate them. When working with the evaluation framework, we found that "legitimacy of the project" was a rather abstract variable for participants to evaluate. Some of the variables, such as "improvements to livelihoods" or "overcoming the inertia" require a longer evaluation period to assess properly.

Overall, getting a community involved with a latent problem through addressing practices they would like to see improved, worked quite well. We identified and implemented adjustments that were beneficial both to the latent problem and to the community's livelihood, but only at project scale and during the project's duration. To have island-wide effects, multiple plots and a longer project period are needed. However, we foresee challenges to upscaling this project, due to what Mills et al. (2017) refer to as "response efficacy": feeling that your behavior will have the intended effect. While this is frequently mentioned as a factor limiting the implementation of policy or adoption of measures (e.g., Keshavarz and Karami 2016), it may also play a role before implementation, when involvement of a community or stakeholders is sought after to decide on what measures or policy to implement. Participants wanted to see the land-use practice changed but wondered whether this project would be able to do so. This goes to show that the latency of Coralita is not the only reason for the community inertia, and other factors such as project efficacy should be addressed in future PAR-L projects as well.

Related to project efficacy, questions regarding Coralita's impact and solutions to its invasion kept resurfacing: thus the latency we tried to work around through PAR-L did not fully disappear from view. Looking back at the grid presented in Figure 7, PAR-L worked mainly to achieve movement along the horizontal axis, by having the community identify points for improvement to practices to benefit their livelihoods. The project addressed a problem that matters to them, namely the lack of agriculture, and by doing so positively affected the latent problem of Coralita invasion. A simultaneous effort to move up the vertical axis should be made too; to achieve this, the literature on, for example, joint knowledge production (Hegger et al. 2012) and socially robust science (Seijger et al. 2016) might be useful in offering analytical and methodological tools for knowledge production that take account of stakeholders' questions, knowledge and interests. PAR-L's focus on improving day-to-day lives could thus be complemented with a knowledge-gathering component, pre-empting the risk that a low sense of project efficacy will keep the community from participating. With these improvements, we think our PAR-L approach is well equipped for overcoming a community's inertia regarding other latent environmental problems such as habitat fragmentation. Whether it would also work for non-latency incited inertia cannot be established based on this one case, but it is definitely suitable for co-creating solutions to problems that communities did not know they had.

Chapter 5

Absent action or crippling conflict? Moving from latency to a manifest problem: trajectories across scientific and public salience

This chapter is under review as: Vaas, J., P.P.J. Driessen, M. Giezen, F. van Laerhoven, M.J. Wassen. Absent action or crippling conflict? Moving from latency to a manifest problem: trajectories across scientific and public salience

ABSTRACT

When people know and care about an environmental problem, does that result in action or conflict? This chapter looks at thirteen invasive alien species in the Netherlands, and reconstructs the development of their public and scientific salience, assessed from the amount of publications in newspaper database LexisNexis and scientific database Scopus respectively. Three trajectories are derived for a latent problem to evolve towards a manifest status. The trajectory where first scientific salience increases, followed by public salience, is the most common. For three species with different degrees of public and scientific salience, we coded the content of newspaper and governmental documents on action and conflict. We found that high public salience coincides with much action, both on the part of the community and the government. Surprisingly, conflict was also higher for problems with high public salience, and it often pertained to the type of action undertaken. An additional factor that appears to mediate the dynamics surrounding action and conflict, is the type of impacts occurring: health impacts resulted in much action and conflict. Ambiguous or uncertain impacts did not appear linked to conflict, which poses questions regarding the need for stakeholder agreement. Based on this research, a species with many stakes involved and knowledge available, results in much action, but also accrues conflict.

5.1 INTRODUCTION

Getting people involved with management of environmental problems is one of the major challenges of environmental governance. To deal successfully with environmental issues, the involvement of communities in the management of the environment is widely accepted as crucial (Folke et al. 2005, Papadopoulos and Warin 2007, Armitage 2009, Turnhout et al. 2010, Lührs et al. 2018). Despite the limited empirical proof for local actors' involvement resulting in better outcomes of decisions (Newig and Fritsch 2009), higher acceptance and implementation of environmental decisions is consistently claimed to follow from participatory processes (Newig et al. 2018). Involvement of stakeholders can be hampered in two general ways: by people not knowing, or not caring. Not knowing could mean that people are ignorant regarding a problem and the risk it entails (e.g., Esteve et al. 2018, Fizer et al. 2018); not caring could follow from people's value system not affording the problem sufficient attention (Tauro et al. 2018), or them being less oriented towards the environment in general (Newig et al. 2018). But when people do fully understand the problem, and there are clear interests at stake, does action ensue?

We explore this question by looking at action undertaken regarding invasive alien species in the Netherlands. Ecologists list invasive alien species (IAS) as one of the major threats to biodiversity, with cost estimates ranging from €12 billion a year for the EU to €120 billion a year for the USA (Pimentel et al. 2005, Shine et al. 2010). To deal with IAS successfully, involvement of local communities is increasingly recognized as crucial (Stokes et al. 2006, Verbrugge et al. 2013, Niemiec et al. 2016). It was shown earlier how for an IAS that poses little threat to a community and on which scant scientific knowledge is available, inertia can arise (Vaas et al. 2019). Acting is refrained from by a community regarding such a latent problem, as there are few stakes involved and scant insights into impacts. Yet, looking at invasion literature, the opposite situation with many stakes involved and plenty of scientific knowledge available, can suffer from inertia as well. For example, cacti in South-Africa cause major harm to biodiversity and human health, but also serve an agricultural and ornamental purpose. These discrepancies hamper collaboration and cohesion between stakeholders, which in turn limits the development and implementation of management strategies (Caplat and Coutts 2011, Novoa et al. 2016). Thus, a manifest problem with high public salience can also result in inertia, and even give rise to conflict. Likewise, high scientific salience, i.e., the availability of ample knowledge, might have adverse effects as well (Cortner 2000, Van Enst 2018). Byers et al. (2002) provide an example of the Zebra mussel, to show how knowledge availability itself is not enough: nature managers were not prepared for dealing with the invasive species, despite the large body of literature available. Alternatively, knowledge can be used strategically by policy makers and scientists alike. Policy makers can ignore insights that are not in concert with their preferences, or use uncertainty and contradictions

within knowledge available to postpone decision-making. Also, knowledge produced by scientists can leave out topics or stakeholder positions that were not considered relevant (Turnhout et al. 2007, Van Enst et al. 2014).

This chapter seeks to explore how different degrees of public and scientific salience coincide with inertia and conflict. To that end, we first reconstruct the development of scientific and public salience for thirteen IAS in the Netherlands. From these reconstructions, we learn how a latent problem can evolve towards a manifest status. Secondly, we explore whether that is desirable, i.e., how different degrees of public and scientific salience coincide with inertia and conflict. We search newspaper and governmental documents on three species representative of different trajectories across public and scientific salience, for mentions of action and conflict. Based on this, we get an idea of whether making people know and care more, is indeed conducive to management of invasive alien species.

5.2 THEORETICAL FRAMEWORK

In this section we outline three analytical elements of this chapter. Firstly, the salience of an issue to the public and science, and secondly the development thereof. Thirdly, action undertaken and conflict risen regarding an invasive species. In the methods section we link these to three research steps.

5.2.1 Scientific and public salience

The first analytical element is the problem status of an invasive species, depending on public and scientific salience. The distinction between these two types of salience follows from a typology for environmental problems, presented as a grid consisting of two axes creating four problem statuses. The vertical axis looks at the predictability of impacts, and the horizontal axis at the threats posed to livelihoods. This is an adaptation of distinctions made earlier by e.g., De Boer et al. (2010), Hurlbert and Gupta (2015), Van Enst et al. (2014) and Gromley (1986), between certainty of science and certainty of values. For this article, we zoom out from the community level to a more abstract national level, and adjust the axes of the grid accordingly. The vertical axis represents the *scientific salience* of an invasive alien species, meaning the amount of scientific attention it has received in for example scientific journals. This is mostly a quantitative measure, and does not say much about the quality of the knowledge available. Likewise, *public salience* on the horizontal axis is a measure for the amount of attention a species gets from society in general; it does not say anything about whether that attention is warranted or not. These two variables result in four problem statuses, that are depicted in Figure 10.

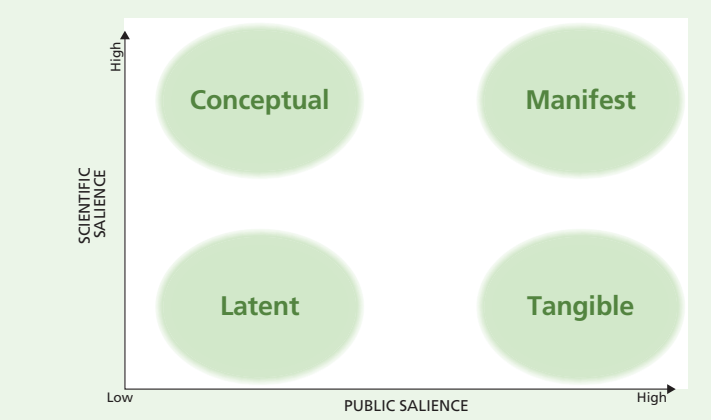


Figure 10. Problem statuses defined by two dimensions: salience to the public on the horizontal axis, and scientific salience on the vertical axis.

A *conceptual problem* is one for which elaborate scientific knowledge is available to predict which impacts will occur where, allowing for a technocratic type of management. Support from a community or government for such measures may however be lacking, since conceptual problems are characterized by bearing little relevance to the public. This is the inverse of a *tangible problem*, which is very salient to the public. However, low scientific salience makes informed management difficult to achieve, and therefore tangible problems can be expected to spur perception-based management. When both scientific knowledge is absent and the problem holds low public salience, we are dealing with a *latent problem*. Since there is no public nor scientific concern to act on, latent problems typically do not encourage any management. *Manifest problems* are the complete opposite, characterized by a good understanding of which impacts will occur when, like for conceptual problems, and compounded by a large concern from the public. These are the four statuses we discern, but the problem status of a species is subject to change as both scientific and public salience can change. The next section presents three theoretical trajectories along which the problem statuses can change, which is this article's second analytical element.

5.2.2 Problem status trajectories

Changes in how IAS are regarded, occur frequently. For example, *Rhododendron ponticum* progressed from being an exclusive garden plant to a costly invader, and prickly pear (*Opuntia ficus-indica*) started as an important fodder crop in South Africa, but is now hampering livestock productivity (Dehnen-Schmutz and Williamson 2006, Shackleton et al. 2019). Such shifts in framing can be due to changes in scale: a species starting out in gardens providing an ornamental service, can incur great agricultural damages once it invades pastures (Vaz et al. 2017). But people's perceptions may also change

over time due to changes in what they value, or insights they gained (Shackleton et al. 2019). Many alien species were considered beneficial when they were introduced, such as the rainbow trout in South Africa for fishing, or intended to combat another pest like with the giant toad in Australia (Caplat and Coutts 2011). If, with time, they also turn out to have major negative impacts, their management may become an urgent matter. Other species are initially perceived as a major pest that is zealously managed, only to turn out not to be all that bad after all. This was the case with tamarisk shrubs in the USA, which were heavily suppressed from the 1930s onwards for their alleged water depleting character, costing US$80 million between 2005 and 2009 alone. Yet, their water consumption turns out to be comparable to that of native counterparts, and they are the preferred nesting habitat of the endangered native willow flycatcher (Davis et al. 2011). In sum, changes occur in perceptions of the problem a species poses, both from a scientific and a societal perspective.

Looking back at our grid and translating this to the problem status typology, a species with a latent status could first progress towards a conceptual status as additional knowledge becomes available, which is then picked up by society and pushes the species towards a manifest status. Alternatively, the public could become concerned first, awarding a species a tangible status, followed by scientific efforts at understanding the species, resulting in a manifest status. Alternatively, we discern a trajectory in which scientific and public salience increase simultaneously. Figure 11 depicts these three theoretical itineraries, referred to as route A, B, and C respectively.

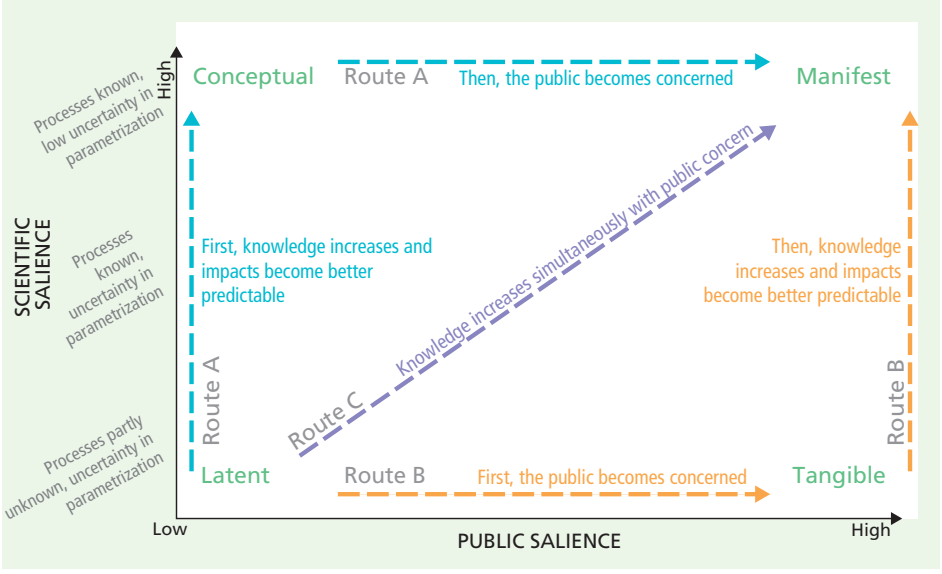


Figure 11. Three theoretical problem status trajectories: route A, B and C.

In this chapter we will reconstruct the trajectories across problem statuses for thirteen invasive alien species in the Netherlands, for two reasons. One, to see if the theoretical trajectories of Figure 11 exist in practice as well. Does the public only become interested once there is ample scientific insight into an invasive species, or does scientific attention follow on public concern? And second, to explore the tension mentioned earlier, of having people care for an issue to avoid inertia, and conflict arising instead.

5.2.3 Inertia or conflict?

It was shown earlier how latency results in difficulties with identifying stakeholders, because there is not enough information regarding impacts for people to articulate positions towards (Vaas et al. 2019). When the impacts are better predictable, people can articulate opinions regarding them, and stakeholder groups will appear. Following this reasoning, a conceptual, manifest or tangible problem status should be conducive to action: there are clear stakes involved, and these stakes affect a community.

But, in invasive species literature, the existence of multiple stakes is generally linked to conflict. Novoa et al. (2018) define a "conflict species" as one for which there are medium to high costs and benefits involved, which are distributed across multiple actors. Dealing with conflict species requires dealing with multiple stakes and stakeholders, and Woodford et al. (2016) contend that this is when invasive species management becomes particularly tricky. They even suggest that the aim of eradication in such cases becomes unattainable. For example, pine trees (*Pinus* species) that were planted in the 1930s in South Africa to provide timber, are now invading the native fynbos shrubland. Foresters and conservationists have opposing stakes, and as the trees continue to spread, the conflict becomes increasingly intractable. Another classic conflict species is the earlier mentioned rainbow trout *(Oncorhynchus mykiss)*, which was introduced all over the world for sport fishing purposes, but threatens local fish species (Woodford et al. 2016). Thus, higher public and scientific salience might result in clear stakes and entice action, but could also sprout inertia inducing conflict.

In this article we aim to explore this tension by looking at conflict arising and action undertaken regarding invasive alien species with different problem statuses, which is the article's third analytical element. Both will be operationalized in the methods section, but here we briefly point out the distinction between governmental and community action. Responsibilities for IAS management are divided across multiple levels, from the European Union all the way down to that of water authorities and municipalities (European Parliament and Council of the European Union 2014, Provincie Gelderland 2018). Next to these *de jure* institutions, Sullivan et al. (2017) show how oftentimes *de facto* institutions emerge to complement the governmental policies. When community actors feel governmental policy is not sufficient, they can develop their own initiatives, which was done for example by Landcare groups regarding the invasive weed serrated

tussock *(Nassella trichotoma)* in south eastern Australia (Marshall et al. 2016). We thus distinguish two kinds of action undertaken regarding an invasive alien species: governmental action and community action.

In the foregoing, three analytical elements were presented to explore how different degrees of public and scientific salience, i.e., different problem statuses, coincide with inertia and conflict. Namely, a typology of problem statuses a species can have, the trajectories along which these could theoretically develop and the concepts of action and conflict. The next section links these analytical elements to three methodological steps, applied on thirteen IAS in the Netherlands.

5.3 METHODOLOGY

In this chapter we will reconstruct the problem status trajectories of a carefully selected set of invasive alien species, and assess the action and conflict pertaining to them. The three research steps for doing so are explained here, as well as the selection of species focused on.

5.3.1 Thirteen invasive alien species in the Netherlands

We look at invasive alien species present in the Netherlands, which is a spatial scale at which a comprehensive impression of action on the part of the community and government can be obtained, without having to account for differences in jurisdiction. The Dutch species database lists 148 invasive alien species in The Netherlands (Nederlands Soortenregister, accessed 19 February 2019), from which we selected thirteen species. These are the species that were mentioned by more than one of the four sources representative of four different types of actors: scientific, civil society, nature management organizations, and a governmental source. By selecting species from such diverse sources, we prevent a bias towards scientific or public salience. As a *scientific source* we used the article by Verbrugge et al. (2013), in which a group of invasive species that have different levels of appeal and impact on biodiversity is presented. As a *governmental source*, we used the species listed by the EU directive on invasive alien species as to be managed by the member states (European Parliament and Council of the European Union 2014). As a *civil society source*, we asked the chairman of the main civil society organization in the Netherlands regarding invasive species "Platform Stop Invasieve Exoten" (Reinhold p.c. 2019) for the most important IAS. As representative for *nature management organizations* we used a list of species mentioned in Boomblad, a magazine published by Alterra (Holtjer 2009). This magazine published a list of most prominent species in the Netherlands based on input from several nature management organizations, at the occasion of the national government establishing its first Team Invasive Aliens. We list the species

mentioned by these different sources in Table 44 in the Appendix. Newspaper articles often conflate Coypu and Muskrat, so we excluded Muskrat. We added Japanese knotweed *(Fallopia japonica)* and Quagga mussel *(Dreissena bugensis)*. Japanese knotweed because it has been raising a lot of attention recently (LexisNexis shows multiple hits per day), and Quagga mussel since the chairman of the NGO we spoke with, mentioned this as a species for which scientific salience changed, which rarely happens. The result is a list of thirteen species (Table 15), for which we will reconstruct the problem status trajectories, as explained in section.

Taxonomic group	Common name	Common Dutch name	Latin name
Invertebrate	Asian tiger mosquito	Aziatische tijgermug	*Aedes albopictus*
Mammal	Coypu	Beverrat	*Myocastor coypus*
Bird	Egyptian goose	Nijlgans	*Alopochen aegyptiacus*
Aquatic plant	Floating pennywort	Grote waternavel	*Hydrocotyle ranunculoides*
Mammal	Grey squirrel	Grijze eekhoorn	*Sciurus carolinensis*
Bird	Japanese housecrow	Huiskraai	*Corvus splendens*
Terrestrial plant	Japanese knotweed	Japanse duizendknoop	*Fallopia japonica*
Mammal	Pallas' squirrel	Pallas' eekhoorn	*Callosciurus erythraeus*
Vertebrate	Pumpkinseed sunfish	Zonnebaars	*Lepomis gibbosus*
Invertebrate	Quagga mussel	Quaggamossel	*Dreissena bugensis*
Mammal	Raccoon	Wasbeer	*Procyon lotor*
Freshwater invertebrate	Red swamp crayfish	Rode Amerikaanse rivierkreeft	*Procambarus clarkii*
Bird	Ringnecked parakeet	Halsbandparkiet	*Psittacula krameri*

Table 15. The thirteen species for which the problem status trajectories will be reconstructed

5.3.2 constructing trajectories

During the first research step for exploring the link of different problem statuses with action and conflict, we establish the current problem status of the thirteen species. The second step is to reconstruct the trajectories towards these statuses. This serves to verify whether the trajectories depicted in Figure 11 indeed occur in practice, and to select species representative of different trajectories for which to assess the occurrence of conflict and action.

The problem status of a species is defined by its public and scientific salience. For *public salience*, the amount of publications in Dutch newspapers and magazines is taken as a proxy. When a problem raises concern among a community – because it poses a threat to their livelihoods or is perceived as doing so – it can be expected to receive attention from journalists. Therefore, we look at the records in the LexisNexis database regarding the scientific name and common Dutch name, as listed in Table 15. LexisNexis has publications starting from 1990, but the earliest record on any of our thirteen spe-

cies stems from 1997. For *scientific salience* we look at the amount of records in Elsevier's Scopus database, which has records on these species starting from 1980. This can be considered a proxy for the amount of scientific attention that has been awarded to a given species. We assume that a higher amount of scientific publications results in a better predictability of impacts, due to increased understanding of processes and higher parametrization. In the Scopus database, we searched only for Latin names, as adding the common names made little difference in amount of hits, but does raise debates about what the common name is. For each of the thirteen species, we downloaded an overview of the amount of publications from the Scopus and LexisNexis databases. For the Scopus publications of the Tiger mosquito, the amount of publications was too large to process, and we added "alien OR nonnative OR invasive" to the query.

To *establish the problem status* per species, we compare the amount of records in Scopus and LexisNexis across the species. The four species with the highest amount of LexisNexis records compared to the other species, are ranked highest for public salience. The four species with the highest amount of Scopus records compared to the other species, are ranked highest for scientific salience. And the inverse: the four species with the lowest amount of LexisNexis and Scopus records compared to the other species, are ranked lowest on public and scientific salience respectively. If the amount of records is not explicitly low or high, they are ranked intermediate. Combining the rankings on these two indicators determines a species' location on the salience grid.

To *reconstruct the trajectories* of the species, we look at the sequence in which both indicators developed. If the amount of Scopus records increased before the amount of LexisNexis records increased, this is perceived as route A from Figure 11. For route C the LexisNexis records increase first, and when both sources increase simultaneously it is interpreted as route B. These reconstructions will show how a species can arrive at a manifest problem status – whether that is indeed worthwhile is explored by looking at the conflict and action occurring, as described next.

5.3.3 Assessing action and conflict

The two steps described above will show how an invasive alien species can evolve from a latent problem towards a more manifest problem status. Earlier we discussed how the higher public and scientific salience can be expected to accrue more management action, since there are more stakes involved and knowledge available. However, we also relayed contradicting insights on conflict species and misuse or abuse of knowledge. So the question remains whether progressing towards a manifest problem status is beneficial, which is the third research step outlined here. From the reconstructions of the trajectories, we will derive a few archetypical trajectories. For each of these archetypical trajectories we select one representative species, for which we assess the occurrence of

action and conflict. The indicators for doing so are listed in Table 16, varying between the content and the amount of publications.

Source and search query	Assessment indicators	Indicator of:
LexisNexis *www.academic.lexisnexis.nl* LexisNexis > Power search > search terms [Latin name & common name] & select source by type: Dutch news	Number of records NVivo analysis of content	Public salience Conflict; community action
Official announcements of national government *zoek.officielebekendmakingen.nl* > P*arlementaire documenten* [latin name & Dutch common name]	Number of records Scanning of content	Governmental action Conflict; governmental action
Open Staten archive for provinces *Openstateninformatie.nl* [abbreviated common name + latin]	Number of records Scanning of content	Governmental action Conflict; governmental action
Water authority Rivierenland archive *https://rivierenland.notubiz.nl/* [common name + latin]	Number of records Scanning of content	Governmental action Conflict; governmental action
Scopus *www.scopus.com* ABS-TIT-KEY: [Latin name]	Number of records	Scientific salience

Table 16. The databases searched (left column) to establish problem statuses, conflict and action (right column) for different species, based on either amount or content of the records (middle column).

As discussed in section 5.2.3, we distinguish between two types of action regarding an invasive alien species: governmental action and community action. To establish *governmental action*, we look at the records of several Dutch governmental bodies, across which responsibilities have been divided. The Ministry of LNV is responsible for those listed in the Visserijwet, and the water authorities for the species that are listed in the Waterwet. The Ministry is also responsible for complying with the European Directive on IAS (European Parliament and Council of the European Union 2014), but has devolved the execution to the provinces. Thus, IAS not explicitly assigned to other governmental bodies by Dutch law, are responsibility of the provinces. However, in the program presented by province of Utrecht, tasks are in turn devolved to other bodies among which the water authorities. Also, doubts regarding the Ministry's aptness for dealing with the species within their mandate are expressed, and the province appears inclined to take measures itself (Provincie Utrecht 2019). Given these overlaps, for each species we will look at policy development by all three bodies. For the national government, documentation of policy attention within a ministry is not easily acquired for the public, which is why we combine records of regulations implemented and questions posed by the Second Chamber to Cabinet. The archives of the provinces and water authorities are all separate and differ in types of documents made accessible, which poses significant limitations to the analysis. Some provinces and water authorities do not publish any of

their meeting documents, and when they do, the documents are often scans that are not amenable to text searches. Thus, for the provinces we worked with the archive offered by the NGO "Open Staten", that made documents of five provinces searchable (Limburg, Flevoland, Utrecht, Zuid-Holland and Noord-Holland). By researching the records of these five provinces, we can assume that each species will be invasive in at least one of the provinces, guaranteeing the availability of documents. For the water authorities, we use the archives of the water authority Rivierenland for two reasons. One, since it was mentioned by an IAS expert from the Water Authority Research Association (STOWA) as a proactive water authority regarding invasive species (p.c. Van der Wal 2019). And two, since the archive is easily searchable. For the species chosen as representing archetypical trajectories, we search these archives to assess the *governmental action* undertaken regarding them.

To assess what *community action* has been undertaken, and whether conflict exists regarding these species, we analyzed the 100 most recent LexisNexis publications per species. Using NVivo v.12 software, we coded for *conflict* (both agreement and disagreement) and *action* (both by government and the community). We conducted axial coding, setting the categories in advanced and adjusting them during the process if found expedient (Wald et al. 2019). *Community action* ranges from NGOs, individual citizens, or civil society organizations undertaking any kind of activity regarding an IAS. Activities can vary from organizing hikes, to lectures, to individual citizens undertaking management actions. For *conflict*, we coded everything from opposing opinions, to disavowals of other actors' actions, to unwillingness to work with other actors. An overview of the databases searched per indicator can be found in Table 16.

5.4 RESULTS

5.4.1 Problem status trajectories

5.4.1.1 Problem statuses per species

For the thirteen selected species, problem statuses were assessed based on the amount of scientific and Dutch news articles, as explained in section 5.3.2. The results are shown in Table 17.

There are two manifest species: the Tiger mosquito and Raccoon both have relatively the highest amount of scientific and newspaper articles. There are also two latent species, namely the Pallas' squirrel and Japanese housecrow, for which both scientific and newspaper articles are relatively low. The Coypu falls in the middle of all four quadrants, ranking medium on both scientific and newspaper publications. There is one species with a tangible problem status, the Egyptian goose, which ranks explicitly low on sci-

Species	All species		A.tiger mosquito		Coypu		Egyptian goose		Fl. pennywort	
Source	SC	LN	SC	LN	SC	LN	Sc	LN	SC	LN
TOT	6382	7591	418	689	357	548	55	1011	50	562
PERC	100%	100%	> 28%	9%	6%	7%	1%	13%	1%	7%
Species	Grey squirrel		Jap. housecrow		Jap. knotweed		Pallas' squirrel		Pumpk. sunfish	
Source	Sc	LN	Sc	LN	Sc	LN	SC	LN	Sc	LN
TOT	500	236	110	53	228	1308	77	184	514	266
PERC	8%	3%	2%	1%	4%	17%	1%	2%	8%	4%
Species	Quaggamussel		Raccoon		Red sw. crayfish		Ringn. parakeet			
Source	SC	LN	SC	LN	Sc	LN	SC	LN		
TOT	373	78	1394	1857	1774	549	178	39		
PERC	6%	1%	22%	24%	28%	7%	3%	1%		

Table 17. Relative amount of Scopus (SC) and LexisNexis (LN) publications for thirteen IAS in the Netherlands. The colors are used to indicate the four lowest (red) and four highest (green) relative number of publications. For example: for the Grey squirrel, the amount of Scopus publications since 1980 is 8% of the amount of Scopus publications for all 13 species, which is why it is colored green. For Tiger mosquito the amount of records was much higher, as explained in section 5.3.2 (28% refers to the adjusted more selective query).

entific and explicitly high on amount of newspaper publications. Somewhere between a tangible and manifest problem status, there is Japanese knotweed, ranking high on LexisNexis and mediocre on Scopus. In between a latent and conceptual status are the Ringnecked parakeet and Quagga mussel. Three species, the Pumpkinseed sunfish, Red swamp crayfish and Grey squirrel, have a problem status between conceptual and manifest. A graphical visualization of this is given in Figure 12.

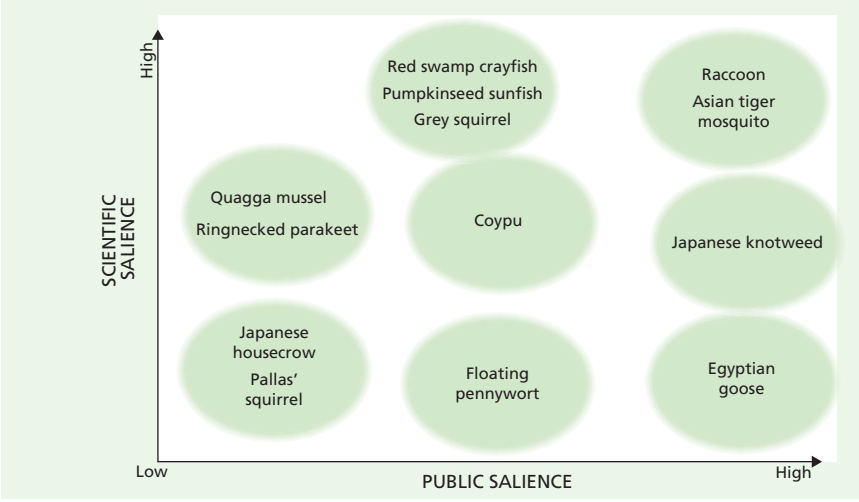


Figure 12. Problem statuses of thirteen IAS in the Netherlands, as defined by their relative amount of Scopus publications (vertical axis) and LexisNexis (horizontal) publications.

5.4.1.2 Problem status trajectory per species

Graphs of the publications through time for all thirteen species can be found in the Appendix. Looking at the sequence in which scientific and public attention for an IAS develop, three general trajectories can be discerned, which we will refer to as Sophos, Pathos and Ambos. Sophos is the trajectory where first mainly scientific knowledge is produced, and the public attention follows markedly later. Pathos is the opposite trajectory, where public attention dominates first, and scientific information follows later. When both types of attention increase at the same time, the trajectory will be referred to as Ambos. The respective trajectories will be illustrated by discussing an invasive species for which attention developed according to that trajectory. They are depicted in Figure 13, with the different colors coinciding with the three different trajectories discerned.

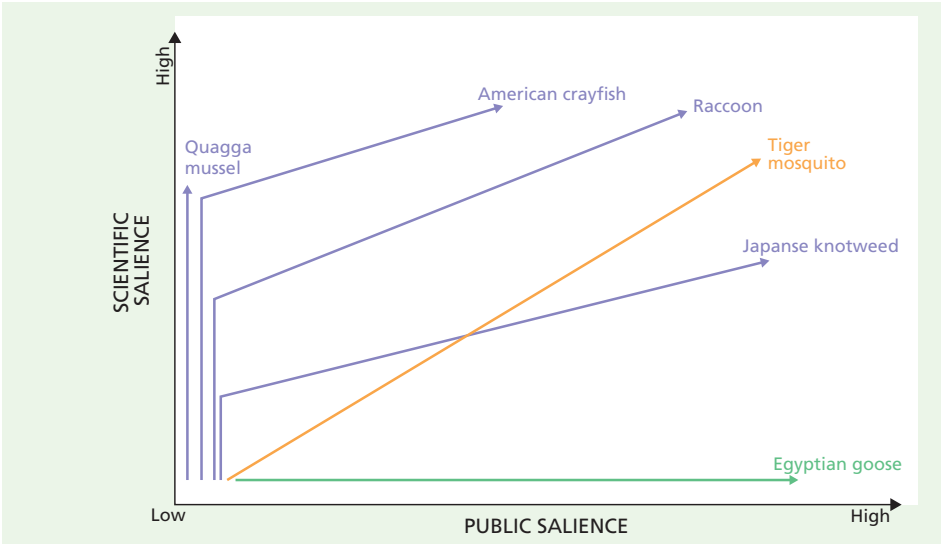


Figure 13. The different trajectories found in practice, indicated by different colours: purple for *Sophos*, orange for *Ambos*, green for *Pathos*. A trajectory is a representation of the order in which public and scientific salience increased through time.

Regarding the *Pathos trajectory*, it is important to note that the species following that trajectory (Egyptian goose) receives conspicuously little scientific attention. The Egyptian goose has a tangible problem status, meaning that scientific attention is very low. The graphs below (Figure 14) do show some clear peaks for Scopus publications, but these should be understood as representing only a very low absolute number of publications. Hence its tangible problem status. From 2008 onwards, the accelerating increase in public attention was followed by some increase in scientific attention as well.

Japanese knotweed, which also ranks explicitly high on public attention, ranks higher on scientific attention than the Egyptian goose. However, when looking at the sequence

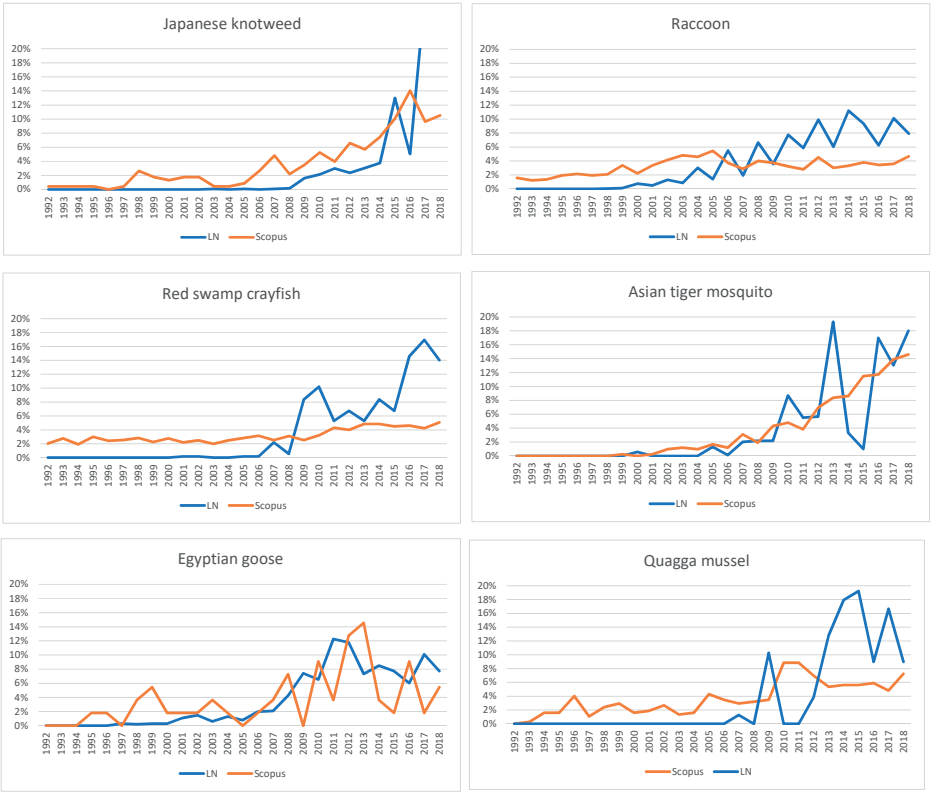


Figure 14. The percentage of publications per source (Scopus and LexisNexis), throughout the years, for the six invasive alien species shown in Figure 13.

of the scientific and public publications, the former's rate increased first, and was followed by public publications only later. Therefore, Japanese knotweed follows the *Sophos trajectory*, be it that overall it ranks higher on public attention than scientific attention. Which differs from another species that followed the *Sophos trajectory*, namely the Raccoon. For the Raccoon, scientific attention grew first and public attention followed, but it ranks highest on both types of attention, rendering it a manifest problem. The public attention also picked up much later regarding this species (around 2004), when there had already been a strong increase in scientific publications. For Japanese knotweed, around 2007 public salience followed quite closely on the increase in scientific publications. For a third species following the *Sophos trajectory*, Red swamp crayfish, public salience lagged even further behind scientific salience (around 2006). The differences in lags between scientific and public salience increasing, are represented in Figure 13 by the different bending points in the lines. A fourth species that follows the *Sophos trajectory*, is the Quagga mussel. The scientific publications clearly increased before the newspaper articles, and so far the overall amount of newspaper articles is still very low,

which is why this species ranks between a latent and conceptual species. For now it cannot be said with certainty whether the public attention will catch up, moving it towards a more manifest status, or whether it will continue to attract mainly scientific attention.

The third trajectory, *Ambos*, is what the other manifest species followed, the Tiger mosquito. Since for this species, scientific and public salience started to increase at the same time (around 2006), this line runs diagonal across the grid. Now that we have elicited three archetypical problem status trajectories, we will look at representative species for each of them, to explore the action and conflict occurring per status.

5.4.2 Action and conflict for three conspicuous species

We zoom in on three species that are representative of the different trajectories found: the Asian tiger mosquito as representative of the *Ambos trajectory*; the Quagga mussel representing the *Sophos trajectory* and the Egyptian goose as representative of the *Pathos trajectory*. For each of these species we briefly discuss the governmental action undertaken as retrieved from three databases representing the national government, provinces and the water authorities. In addition, we discuss the action and conflict pertaining to that species as mentioned in the newspaper articles. After that, we compare the three species to see if a link between problem status, and conflict or action can be discerned.

5.4.2.1 Asian tiger mosquito, Aedes albopictus

In 2005, the first occurrence of an Asian tiger mosquito (ATM) was recorded in the Netherlands, which presumably made it from Asia to Europe through the transport of car tires and bamboo plants. In 2017 a total of 194 mosquitos were found distributed over 12 municipalities; for 2018 the Netherlands Food and Consumer Product Safety Authority (NVWA) reports 39 instances at which the mosquito was found in the Netherlands (NVWA 2019). In June 2018, the European Center for Disease Prevention and Control (ECDC) deemed the mosquito "established" in the province of Limburg in The Netherlands (ECDC 2018), but in January 2019 its status was back to "introduced" (ECDC 2019). The mosquito is mainly feared for its potential to transmit the virus for diseases such as chikungunya, dengue, yellow fever and zika, and its bite is allegedly exceptionally painful. However, given the virtual absence of these viruses in Holland, the national health institute RIVM assesses the health risks to be very low (van der Werff 2018, Meershoek 2018, Dagblad de Limburger 2018). Still, whenever an ATM is encountered somewhere, the NVWA puts out traps and checks water sources in the environmental, striving for complete eradication of the mosquito (Teunissen 2018).

Results from governmental databases

In the governmental documents, a focus on ATM as a disease vector is very clear. The documents reflect how the species started out as an occupational health hazard in 2006 for employees in green houses where the bamboo was grown, and evolved into a public health hazard upon the first sighting in nature in 2010. The health risks are the reason for control, and when the mosquito's alien status is mentioned, it is to reinforce the need to eradicate the species. A dispute on how to prevent introduction of the species was visible throughout multiple years, where the Ministry prefers covenants, and parliament has more faith in import restrictions. In 2007 a covenant with bamboo importing companies was signed, which in 2009 was made binding by converting it into a ministerial regulation. In 2011 this raises criticism from parliament, arguing the import of the plant should be prohibited entirely. Regarding car tires the same dispute exists, for which in 2013 a covenant is signed, again raising criticism from parliament for not being binding.

	Asian tiger mosquito																		Total amount of publications
Year of publication	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Parliamentary						3	7	1	4	5		5	6	3	4	2	2	2		44
Provincial													1				1	2		4
Water authority																			1	1
All																				49

Table 18. The amount of governmental publications for Asian tiger mosquito, broken down per source and year.

Results from newspaper articles

Asian tiger mosquito was most densely coded compared to the other species on almost every variable, except ambiguity regarding impacts: for this, it ties with the Quagga mussel. Both action and inertia are highest regarding this species, which itself is the source of conflict: some public actors argue that the government is not doing enough. The impacts do not spur conflict, as there are only negative impacts reported. This might explain the high amount of action, and the persistence of conflict in spite of it.

Code	**Reference frequency**	**Content of references**
Governmental action	76 ref. 54 art.	- mostly eradication campaigns by NVWA: placing traps, administering larvae-killing substances to standing water, and checking for breeding spots - municipalities are sometimes involved, to inform inhabitants about the NVWA activities - requires cooperation from the community, as the NVWA needs to enter gardens to check for mosquitos and potential breeding spots

Governmental inertia	23 ref. 22 art.	- municipalities refer to the NVWA for management - lack of regulation regarding companies importing tires and bamboo plants - pausing eradication of Asian mosquitos (Ae. albopictus and Ae. Japonicus) in the province of Flevoland while the NVWA and RIVM reassess strategies
Community action	34 ref. 24 art.	- granting NVWA access to garden for eradication campaign - NGO "Platform stop invasive aliens" sues the national government, aiming for regulation regarding car tire importing companies - companies importing tires from countries where the mosquito has established, store these in a dry area and have mosquito traps installed around the area
Conflict	28 ref. 19 art.	- is the national government doing enough, or should the army be involved in eradication? NGO "Platform stop invasive aliens" and scientist Bart Knols argue the latter. - are the health risks posed by the species significant? NGO "Platform stop invasive aliens" and scientist Bart Knols versus RIVM - how will the distribution of the mosquito change through time as a result of climate change?
Agreement	4 ref. 4 art.	- ECDC, NVWA and RIVM agree that the mosquito will establish in the Netherlands - the NVWA and tire companies agree on their cooperation being effective *Note that both these elements are also a source of disagreement*
Negative impacts	66 ref 56 art	- potential to spread diseases - painful bite
Positive impacts	0	none
Ambiguous impacts	12 ref. 10 art.	- uncertainties regarding future spread and where mosquitos that were exterminated came from

Table 19. Amount of references (ref) per coding theme across newspaper articles (art) on Asian tiger mosquito.

5.4.2.2 Egyptian goose, Alopochen aegyptiacus

The Egyptian goose has been in the Netherlands much longer than the Asian tiger mosquito, with the first breeding instance in 1967, after having been introduced to Europe in the 18th century as a decorative bird (Sanders-Kroeze 2018). According to the latest assessments, in 2013-2015 there were between 6900 and 11400 Egyptian geese (which is in fact a duck) in the Netherlands, but their number seems to be stabilizing (RAVON 2019). Their harm lies in their aggressive behavior, taking over territory and nests of even buzzards and goshawks. They can breed multiple times a year and even mid-winter, but there are no indications so far that they have restricted populations of other water birds (SOVON n.d.). The species features in the EU directive regarding invasive species under article 19, meaning member states can decide whether to aim for eradication or control. National policy is to contain the Egyptian goose, for which provinces develop policy and then typically grant a mandate to the Fauna Control Unit (FBE), as done by Utrecht and Gelderland (Provincie Gelderland 2018, Provincie Utrecht 2019).

Results from governmental databases

This species has the highest number of governmental records. It mainly features in provincial documents, rather than national documents as the Asian tiger mosquito did. Also for this species, the alien status is used to emphasize the need for management, but is not the main reason why it should be managed. The danger geese pose to air traffic around Schiphol is the main reason, which resulted in multiple covenants on how to limit their presence. Thus, while the impacts of a native and an alien goose on air traffic are the same, the target number of aliens is much lower than of native species in these covenants. This distinction gives rise to part of the conflict concerning this species, with several NGOs and one party in Second Chamber arguing against targeting alien species specifically. The methods of eradication also give rise to protest, and a court case revolved around the use of carbon dioxide to cull geese.

	Egyptian goose																		Total amount of publications
Year of publication	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Parliamentary	1			3	1	1	1		2	3	10	3	3	6	7	1	1	1		44
Provincial								3	5		5	7	3	22	15	15	12	21		108
Water authority																1				1
All																				153

Table 20. The amount of governmental publications for Egyptian goose, broken down per source and year.

Results from newspaper articles

The newspaper articles on this species are least densely coded, with a large share of the articles mentioning the goose as an example of an invasive species or as a sight to be seen when hiking. This demonstrates the species' public salience, being part of common vocabulary and therefore surfacing in articles not solely devoted to them. Only few mentions are made of impacts of the geese, so whereas for the tiger mosquito its impacts could explain the salience, for the goose they do not. Nor can it be readily derived from the articles why the salience is so high.

	Reference frequency	**Content of references**
Governmental action	24 ref 22 art	- research on the distribution of the species - the design of invasive species policies on the provincial level - shaking eggs or treating them with corn oil, typically on municipal level - lifting of hunting restrictions, for example in the province of North-Holland
Governmental inertia	1 ref 1 art	- city of Leeuwarden will not be undertaking action regarding the Egyptian goose, despite European regulation

Community action	6 ref 6 art	- hikes in which the species features as a sight - public lecture on invasive species - processing geese meat into food - citizens reporting sightings of the species - cooperation initiative on the provincial level between governmental and non-governmental actors
Conflict	8 ref 8 art	- is shooting the geese protecting or damaging nature? The NGO "Natuur- en milieufederatie Zuid-Holland" challenges the decision of that same province to allow the geese to be shot - is damaging the eggs inhumane? - The NGO IVN that organizes "city safaris" is in favour of keeping the species in Rotterdam
Agreement	1 ref 1 art	The province, Natuur & Landschap and Fauna Control Unit of Zeeland agree that current management measures regarding the geese are not sufficient, and suggest among others to broaden the management area
Negative impacts	19 ref 19 art	- threat to native species by breeding at a high rate, taking over nesting sites of other birds and killing chicks of other species - can be aggressive towards humans - posing a traffic hazard, since they are attracted by the grass between tram tracks - like other geese: damage to crops and grasslands, and noise production
Positive impacts	3 ref 3 art	- aesthetical value - serving as food for the European pine marten - foxes prefer eating the Egyptian goose over other pasture birds
Ambiguous impacts	2 ref 2 art	- since geese look for cover to breed while pasture birds prefer an open area, they may not pose a real threat - having a new bird settle in the Netherlands is interesting, but might in the long term do damage

Table 21. Amount of references (ref) per coding theme across newspaper articles (art) on Egyptian goose.

5.4.2.3 Quagga mussel, Dreissena bugensis

The Quagga mussel originates from the Dnieper delta and Black Sea, and made its way to the Netherlands upon the construction of the Rhine-Main-Danube canal or via the ballast water of a ship. At the beginning of the 2000s, the first Quagga mussels were found in Hollandsch diep and the Westeinderplassen, of which the bottom is covered by about 3000 Quagga mussels per square meter. They are also found in the canals in Amsterdam, and often praised for cleaning the water and reducing occurrence of the cyanobacteria, commonly referred to as an algae hampering swimming (Tielemans 2015, Dorrestijn 2015). As will be discussed below, these two impacts both raise some ambiguity.

Results from governmental databases

The Quagga mussel reaps the lowest amount of records in governmental databases, and the majority of the documents express uncertainty or refer to ongoing research. The predominantly positive impacts, as we will get to below, are reflected in these documents: the mussel is referred to as improving the quality of swimming water, solving a

recurring issue with cyanobacteria during summer. The alien status is only mentioned on the side, as compounding the uncertainty of long term impacts. It is not a reason for eradicating the species; rather, governmental actors appear in favor of promoting the mussel's presence, given its supposedly positive impacts.

Year of publication	Quagga mussel																		Total amount of publications
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Parliamentary									1		1	1	1	10	9			1		24
Provincial															3		5			8
Water authority															5					5
All																				37

Table 22. The amount of governmental publications for Quagga mussel, broken down per source and year.

Results from newspaper articles

Despite this species having twice the total amount of references the Egyptian goose does, it has fewer references on action and conflict. Instead, most references pertain to impacts; positive, negative and ambiguous. The filtering capacity of this mussel is presented most often as a positive impact, but also frequently as a negative impact. The low amount of conflict surrounding this species is therefore surprising, as the many repercussions it has throughout the ecosystem can each be valued differently. As with the ATM, human health appears again to be the main point of focus: most attention is on the quality of swimming water, rather than other repercussions on the ecosystem. A large share of the articles refers to pilots in which the species is put to use. It being an alien is only mentioned sporadically, when the uncertainties regarding this species are mentioned.

	Reference frequency	Content of references
Governmental action	18 ref 15 art	- experiments with the mussel filtering water bodies. E.g., water authority Brabantse delta doing tests in a pond in Breda, and water authority Amstel, Gooi and Vecht constructing a "quagga filter" in the Sloterplas. - Ministry of Economic Affairs stimulating such experiments - EU regulation regarding IAS - 2017 regulation from the International Maritime Organization imposing the treatment of ballast water of ships
Governmental inertia	2 ref 2 art	- water authority Rijnland does not see grounds yet for acting and prefers monitoring
Community action	3 ref 3 art	- a dive center sinks Christmas trees to the bottom of the Reeuwijkse Plassen, in order for Quagga mussels to attach to them and improve visibility
Conflict	1 ref 1 art	- disagreement between divers and boat owners, the former against the mussel and the latter in favor of them

Agreement	2 ref 1 art	- embargo on fishing in the Ijsselmeer, with the mussel referenced as one of the reasons for lower fish stocks
Negative impacts	31 ref 27 art	- filtering activity lowers presence of plankton, negatively affecting other species - reduction of fish means fewer sights for divers - clearer water increases plant growth because of more light infiltration - sticking to surfaces such as drainage pipes of electricity plants, boats and docks - outcompeting native mussel species, which has repercussions for native fish
Positive impacts	54 ref 47 art	- filtering results in clearer water, which increases the light availability - higher light availability spurs the growth of water plants and algae, which attracts birds and fish - filtering is generally assumed to reduce the instance of the cyanobacteria, benefiting swimming conditions for humans
Ambiguous impacts	13 ref 9 art	- the filtering capacity results in clear water, but also decreases the presence of plankton, which benefits some species and damages others - does the mussel indeed decrease the presence of the Cyanobacteria? - what will effects on the long term be?

Table 23. Amount of references (ref) per coding theme across newspaper articles (art) on Quagga mussel.

5.4.3 Comparing the three species

Here, we compare the three species regarding the two elements of our research question: action and conflict.

5.4.3.1 How do problem status and action undertaken correlate?

The species with a manifest problem status, the Asian tiger mosquito, is also the species for which we found most activity undertaken by the government and the community: more than half of the articles contained a reference to such action undertaken. Regarding action on the part of the community, only for this species we found many references of that happening: 34, versus 3 and 4 for the other two species. These are partly references to people cooperating with the NVWA by granting access to their garden or reporting sightings, and covenants with tire and bamboo importing companies, but for the majority pertain to the NGO Platform stop invasive aliens and scientist Bart Knols undertaking action. The low community action regarding the Quagga mussel is in line with our expectations, but for the Egyptian goose we would expect the public salience to coincide with action on the part of the community. However, while the citations are low in number, they reflect structural community involvement. The bird collision covenants, as well as the Fauna management programs of the FBEs are both examples of long-term collaboration between government, nature management organizations and private actors. Looking at this, public salience seems to positively correlate with community action.

As for governmental action, the largest amount of references pertains to ATM. Interestingly enough, it is also the species with the highest amount of references on

governmental inertia, which are predominantly assertions of two non-governmental actors, spurring conflict which we will get to later. When looking at the impacts of the ATM, the high degree of action is somewhat surprising, as this species' damage is confined to the realm of hypotheticals: it could spread a certain virus, were the virus to be present in the Netherlands. Yet for the Quagga mussel, which has already changed the composition of entire lakes, much less action is undertaken. This could be attributed to its lower score on public salience, or it could have to do with the type of impact involved: for the ATM we are dealing with a health hazard, whereas the Quagga mussel is mostly perceived as a health benefactor. Which might also contribute to the ATM's high public salience. For the Egyptian goose with a tangible problem status, a much lower share of the newspaper articles refers to action undertaken by the government, but it does have the highest amount of records in the governmental databases. This difference could indicate that journalists are less interested in these activities than the extermination campaigns regarding the ATM, or it could be reflective of the relatively high amount of articles in which the Egyptian goose is merely mentioned and does not play a central role. Based on this, it appears that high public salience coincides with both community and governmental action undertaken.

5.4.3.2 How do problem status and conflict correlate?

Conflict is also highest for the manifest species, and lowest for the Quagga mussel with its limited salience. Despite the amount of action undertaken regarding the Asian tiger mosquito, a large share of conflict sprouts from accusations of inertia. Also, the action undertaken is criticized: parliament deems the voluntary agreements insufficient. For the Egyptian goose, which has high public salience but low scientific salience, conflict is present to the same degree as for the ATM, when comparing it to the amount of references on governmental action. Moreover, in the governmental records more mention is made of conflict regarding the goose than the mosquito. Similar as for the mosquito, conflict pertains for a large share to the type of management measures taken. For the Quagga mussel almost no conflict is reported, neither in newspaper articles nor governmental records. While we cannot be certain whether it is the salience that spurs conflict or the action that comes with salience, it appears that high public salience coincides with conflict.

Looking at the impacts of the species, we would have expected more conflict regarding the Egyptian goose, given the ambiguity of its impacts compared to that of the ATM. For the mosquito there are no positive impacts mentioned, whereas for the goose there is no unanimity concerning its impacts. This is even more surprising for the Quagga mussel, for which only one reference was found concerning conflict, despite the complex repercussions within the ecosystem. Apparently, ambiguity about impacts does not necessarily give rise to conflict. The type of impact involved might play a role, and the

large amount of conflict regarding the ATM could be attributed to the health hazards involved. We cannot derive the cause of conflict with certainty from this assessment, but it does appear that high public salience comes with conflict, whether the impacts are certain or not.

5.5 CONCLUSION AND DISCUSSION

In this chapter we sought to explore whether knowing more and caring more about an invasive alien species results in more action. Having established in an earlier chapter that a lack of understanding and stakes involved resulted in an absence of action, the opposite situation was researched here. To that end, we reconstructed the development of public and scientific salience for thirteen IAS in the Netherlands, and found three typical trajectories. The *Sophos trajectory* was followed by most species, and consists of first an increase in scientific salience, followed by public salience sooner or later. The *Pathos trajectory* starts out with public salience, whereas for the *Ambos trajectory* both increase at the same time. Notably, the two species with a manifest problem status followed a S*ophos* and *Ambos trajectory*. This raises questions on whether a problem ever becomes manifest by starting out as mainly salient to the public. Next, we explored whether a manifest problem status indeed results in action, or incites conflict. Based on our results, it would be both: action is higher for species with higher public salience, but conflict as well. Moreover, the conflict pertained often to the type of action undertaken.

A caveat to these findings is that the proxy of newspaper articles to assess a species' public salience, may have resulted in a selection bias towards species with conflict and action. Either since these are interesting phenomena to report on, or inversely, press cover might encourage action to be undertaken and conflict to arise. When research would aim to make causal claims, public salience should be measured differently. But for the purpose of our research we do not need to disentangle the underlying dynamics of public salience.

Our finding that action and conflict do not preclude each other calls into question efforts within environmental governance aimed at creating agreement among stakeholders in order to promote action. Although the exact relation between problem status, action and conflict cannot be derived from this research, it might be that conflict does not hamper action, or that action always generates conflict. It might even be that conflict is conducive to action, for example because governmental actors feel pressure from their constituency to act. Likewise, literature on so-called constructive conflict (Cuppen 2012), argues that conflicting perspectives are required for social learning and reaching the best outcome. It also shows how conflict can be used in order to further a specific stakeholder's goal (Maclean et al. 2015). However, in other cases the need for consensus

building among conflicting views exists (Newig et al. 2018, Tauro et al. 2018). Further research is needed to elicit the precise dynamics at play, but a distinction between conducive and detrimental conflict seems in order.

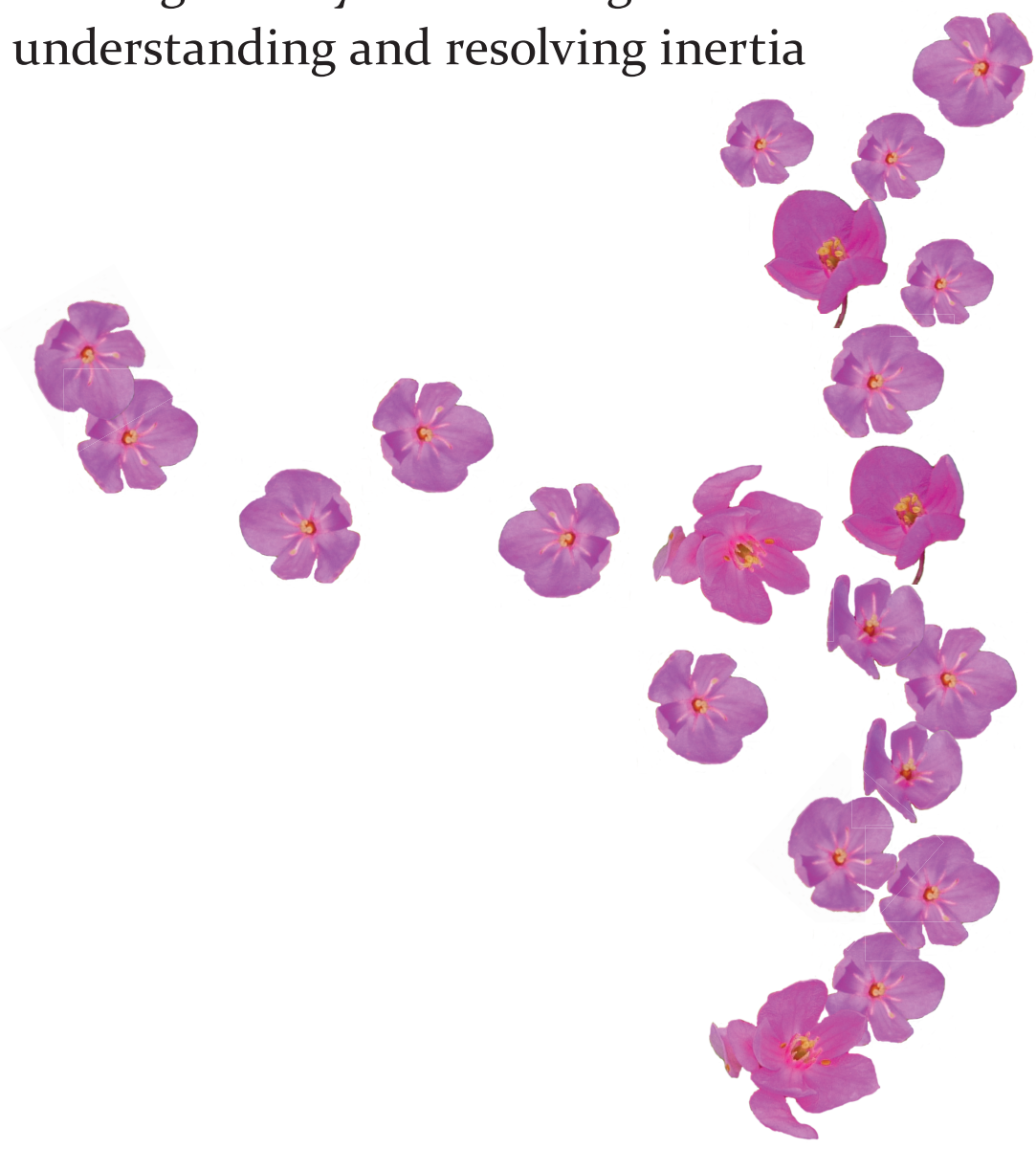
Regarding invasive alien species, the results have two main implications. One, that a species' impacts appear to affect action more than whether it is alien. And two, that low likelihood of impacts does not preempt action, and unambiguous impacts raise more conflict than ambiguous ones. Regarding the former, in our findings the label "invasive alien" served mainly to corroborate or enhance actions already decided on: for the Asian tiger mosquito it adds to the reasons for wanting to exterminate it; for the Egyptian goose it is a legitimization for stricter management compared to other geese; and for the Quagga mussel it is no reason not to experiment with it. This confirms the usefulness of conceiving an invasive species in terms of the public and scientific salience, rather than ecological perspectives such as the barrier model (Richardson et al. 2000). Both perspectives are valid, but when wanting to understand and promote action, pushing for a manifest problem status might be more useful than stressing the invasion stage of the species.

A manifest problem status may however to a large extent be dependent on the type of impacts of the species. This has been pointed out earlier (e.g., Verbrugge et al. 2013, Shackleton et al. 2019) and for the three species researched here, human health impacts appeared decisive: potential positive impacts resulted in enthusiastic employment of the Quagga mussel, while potential negative impacts resulted in extermination efforts for the Asian tiger mosquito and criticism of the action undertaken. Diverting from generally held beliefs in invasion literature (e.g., Woodford et al. 2016, Novoa et al. 2018) we found that a species with ambiguous impacts or a disparity in perceptions among stakeholders, did not incite much conflict. The Quagga mussel can be perceived very differently by fisher people, boaters, divers, swimmers and ecologists, and yet it spurred less conflict than the straightforward impacts of the Asian tiger mosquito. The low public salience of the mussel may imply that too few people know of it for real conflict to arise, but this dynamic requires further research. How risks are perceived could be helpful there (e.g., Estévez et al. 2015, Robinson et al. 2017). Either way, the tension between having people care and avoiding conflict, showed to be more of a challenging combination. When prepared for that, a manifest problem status is worth striving for.

Chapter 6

Scientific synthesis

Leaving latency and moving manifest: understanding and resolving inertia



6.1 WIDELY RESENTED, YET WIDELY NEGLECTED

This dissertation started out with a sense of wonder at the lack of action regarding a widely resented and ecologically significant threat, posed by the persistently invading alien Coralita vine on the Caribbean islands Saba and St. Eustatius. How to square the alarm among ecologists and locals about the ever-spreading pink flowers with the inertia on the side of government and community alike? Environmental governance literature is well capable of explaining a lack of action regarding phenomena that people do not acknowledge as problematic, but Coralita certainly is an infamous and disliked phenomenon by all these actors. Hence the research question of this dissertation:

How can the policy and management inertia regarding the invasive alien Coralita vine on Saba and St. Eustatius be explained and resolved?

In the foregoing chapters, several explanations were discussed and avenues to resolving the absence of action offered. Chapter 2 showed how a polycentric governance arrangement on paper may in practice hamper policy development when the division of budgets and responsibilities are unclear. Stakeholders have trouble articulating their perceptions regarding Coralita due to a lack of knowledge on its impacts, as discussed in chapter 3. These two factors contribute to what is referred to as policy inertia. A second element of the lack of action was discussed in chapters 4 and 5, namely management inertia due the problem's latent problem status. In section 6.2, both types of inertia are elaborated on, followed by a discussion of latency as a problem status, which answers the first part of the research question. The second part of the research question is answered in section 6.3, and two avenues for resolving the lack of action by lifting the policy and management inertia offered.

6.2 EXPLAINING THE LACK OF ACTION: POLICY AND MANAGEMENT INERTIA

Understanding why a given environmental issue is not acted upon is one of the major themes in environmental governance literature, and explanations range from deliberate to unintentional reasons for not acting. For example, the benefits of acting can be lower than the costs, rendering it rational to not act (Munck af Rosenschöld et al. 2014). Another deliberate type of not acting is what Bachrach and Baratz (1963) call a non-decision, when a community knows that existing authorities, powers and values will keep them from addressing the issue. Alternatively, not acting can be unintentional, resulting from an impasse (sensu Biesbroek et al. 2014) or gridlock (sensu Jones and Baumgartner 2012), both following from incompatible or opposing interests and opinions. Similarly, inertia

can occur in a situation where the pressure to adapt does not outweigh the pressure to continue extant institutional routines. Giezen (2013) defines this as: "(…) the inability to make a change when it is required or when it would be beneficial (…)" (Giezen 2013, 726). The inertia analyzed in this dissertation sits somewhere in between: the latency of the problem renders acting disadvantageous, yet the current manifestation of the vine is not the result of deliberate (not) acting, but rather emanates as a corollary to land-use practices it is embedded in. For the purpose of this dissertation, a distinction was made between policy inertia and management inertia. The former pertains to the design, development, or implementation of policy; the latter looks at on the ground management activities, aiming to control Coralita. In the following sections both types of inertia as encountered on Saba and Statia are analyzed.

6.2.1 Why is there policy inertia?

A clear absence of policy regarding Coralita on Saba and Statia was found, as discussed in chapter 2, despite the highly polycentric governance configurations of the respective islands and the Kingdom of the Netherlands. This observation seems at odds with the literature on polycentric configurations, that asserts polycentricity enhances the adaptiveness and robustness of governance arrangements (Folke et al. 2005, Pahl-Wostl and Knieper 2014, Marshall et al. 2016), motivates voluntary cooperation (Marshall 2009) and has potential to outperform larger centrally controlled arrangements (Ostrom et al. 1961, Andersson and Ostrom 2008). On paper, the governance configuration is quite high up the polycentric spectrum: there is a strong overarching system, within which the islands push vehemently for autonomous decision-making. From a polycentric perspective, the autonomy allows for adjusting policy to local circumstances, while the overarching system safeguards the coherence between all entities; this should be conducive to developing the most appropriate policy to tackle a problem such as Coralita. And indeed, for the French Caribbean overseas territories, the overarching system ensures that environmental goals are reached, and provides the resources for the local entities to do so. The French islands have the liberty to spend these resources however they deem fit for reaching the goals set by the overarching system. But in the Dutch case, the role of the overarching system (i.e., The Netherlands) is less clear. Since the governance configuration's inception in 2010, the islands have pushed for more autonomy, while at the same time the overarching system has enhanced its regulations. Goals regarding IAS management were set by the overarching system, but the islands claim the resources needed for realizing these are not provided. The uncertainty about the division of responsibilities and mandates, and their concomitant budgetary arrangements, results in policy inertia: the development of policy is virtually suspended until these matters are clarified.

This policy inertia is compounded by an absence of clear stakeholders to exert pressure on policy makers, and whose perspectives can be involved in policy development. The existence of actors that self-identify as stakeholders is typically presumed in the environmental governance literature. This is reflected in a wide range of literature available on stakeholder analysis and involvement methodology (e.g. Vasslides and Jensen 2016, Lopes and Videira 2016). Sometimes, stakeholders' preferences are acknowledged to be unarticulated, but the approaches assume that these can be elicited to identify stakeholders nonetheless (e.g., Tompkins et al. 2008). Challenging that assumption, chapter 3 argues that when the impacts of an environmental problem on livelihoods are unclear, stakeholders' problem perceptions are rendered latent. This is problematic since constituency pressure is necessary to push politicians to take action, and stakeholder involvement is required for developing relevant and legitimate policies on IAS and for ensuring implementation and compliance (Sharp et al. 2011, Shackleton and Shackleton 2016, Niemiec et al. 2016).

The explanation of policy inertia lies thus with dynamics within the polycentric governance arrangements and the latency of stakeholder perceptions. Yet, this does not preclude management of the vine by individual community members, as happens often when a formal institution is not fulfilling its role (Sullivan et al. 2017). But aside from a few sporadic clearings, no evidence of community initiatives regarding the removal or containment of Coralita on both islands was found: how to explain this management inertia?

6.2.2 Why is there management inertia?

Why Coralita manifests itself on Saba the way it does, was explained in chapter 4 through an aggregate of practices and sticking points that produces a vicious cycle of free-roaming goats, limited agricultural activity and large stretches of unused land, offering plenty of area for Coralita to spread. Notwithstanding important differences between the islands, most notably regarding agricultural activity, these practices and sticking points have explanatory value for Coralita's manifestation on Statia as well. On both islands, about 90% of land is privately owned and spatial planning regulations are absent. Statia has a spatial planning ordinance, but its status is unclear and it does not stipulate anything about IAS management (Island Council St. Eustatius 2011). Saba does not have such a plan, and citizens are very wary of any restrictions pertaining to private land, as land is considered a major asset (Schoenmaeckers 2010). In that setting, regulation from the government imposing restrictions or obligations regarding IAS on private land is highly unlikely to be developed. Thus, it is up to the land owners themselves to manage Coralita. Given the widely voiced dismay about the vine and worry about its continuous spread, one would expect efforts from private landowners to contain and remove Coralita from their land. But during the four years of fieldwork for this disserta-

tion, only a few sporadic cleaning efforts were found. How to explain this management inertia?

When a community is not acting on an environmental issue, a common diagnosis on the part of environmental governance scholars is a lack of awareness among community members. Either they are ignorant about the problem and the risks it entails (e.g., Esteve et al. 2018, Fizer et al. 2018), or their value system does not afford the problem sufficient attention (e.g., Joubert and Davidson 2010). Either way, efforts focus on getting people to understand and acknowledge the problem at hand. But chapter 4 offered an alternative explanation of a community's lack of action, namely the latent problem status of the environmental problem. Latency was defined as comprising highly uncertain impacts and posing little threat to livelihoods, as opposed to a manifest status when impacts are very predictable and pose a large threat to livelihoods. This dissertation argues that for problems with a latent status, inertia on the side of the community is not attributable to the community's perceptions or awareness. Rather, it pertains to the problem itself: if the problem does not pose a threat to livelihoods and there is a shortage of knowledge, a community is not inclined to act. Chapter 4 illustrated this by showing how the aggregate of practices in which a problem is embedded is not adjusted by a community, in spite of general weariness regarding that problem. Encouraging the community to act should thus not focus on raising awareness or adjusting perspectives, but deal with the shortage of knowledge available and threats posed to livelihoods. In section 6.3 it is discussed how to encourage communities faced with latent problems to act, but first we look at the result of the policy and management inertia as they interact.

6.2.3 Interplay of policy and management inertia

Summing up, dynamics within the polycentric governance configuration, and the latent problem status of Coralita result in policy and management inertia. Jointly, these two types of inertia mean that no changes are made to the current manifestation of Coralita following from the daily land-use practices of Saban and Statian community. This is the central explanatory argument of this dissertation, as depicted in Figure 15. It shows policy inertia following from uncertainties in the governance configuration, which was discussed in chapter 2, and from the lack of readily identifiable stakeholders, as discussed in chapter 3. Management inertia is shown to follow from the latent problem status as well, as discussed in chapter 4. And due to these inertias, Coralita is left to grow where it grows. Feeding into these three explanatory clusters is a cluster of daily land-use practices of the community, which were discussed for Saba in chapter 4. These affect Coralita's current manifestation by providing large stretches of unused land to cover, and add to inertia through the high costs of acting on Coralita. Next to that, the practices affect the latency of the problem, as the low threat Coralita poses to livelihoods on both islands follows from the land-use practices, which contribute to

the limited agricultural activity. In turn, the practices are affected by the other three explanatory clusters: Coralita's presence and the inertia pertaining to it, exacerbate the lack of land-use. Also, the uncertainties in the governance configuration mean little spatial planning and land-use restrictions exist, allowing the practices to persist. Lastly, the explanatory clusters affect each other in two other ways. One, Coralita's current manifestation adds to the latent problem status, as it downplays the potential impacts: people see it growing on unused land and experience little negative impacts from it. Secondly, the policy and management inertia allow the uncertainties in the governance configuration and the latent problem status to persist. Thus, a vicious cycle results, but in section 6.3 suggestions for breaking through that cycle will be made.

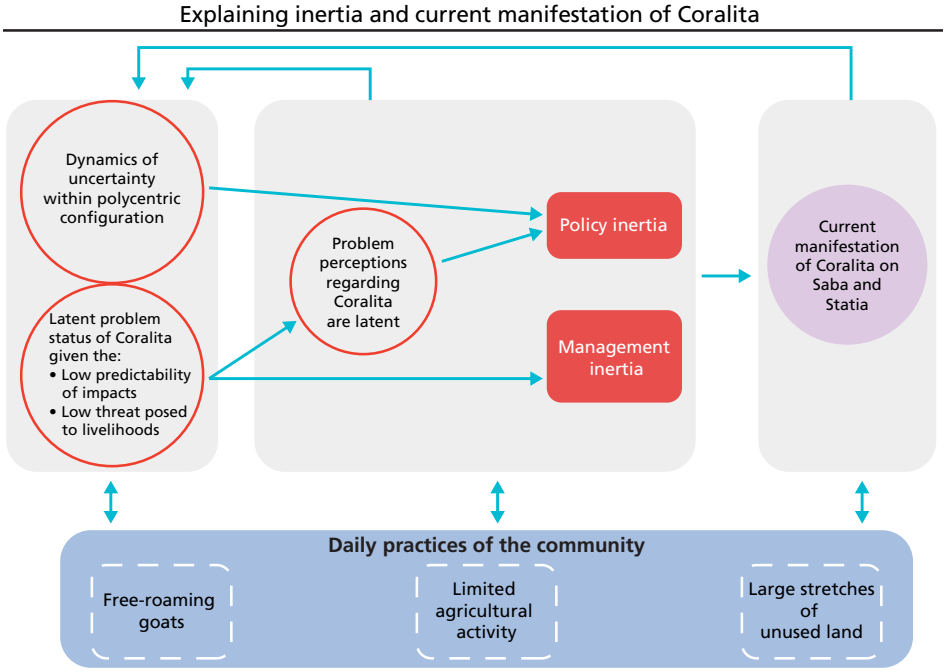


Figure 15. Dynamics addressed in this dissertation regarding Coralita on Saba and St. Eustatius, with three explanatory clusters (in grey) and the cluster of daily practices (in blue).

The foregoing explains the specific case of inertia regarding Coralita on Saba and Statia, as was the purview of this dissertation. It is not asserted to be generalizable to every case of inertia regarding an invasive alien species, since many other elements can be at play. However, the basic dynamic of problem status affecting inertia, and inertia affecting a species' manifestation, can be assumed to feature regarding every invasive alien species. How it plays out exactly, and what the links with the governance configuration, daily practices and possibly other elements are, will differ per species. What does this insight add to extant environmental governance literature on addressing problems?

6.2.4 Scientific contribution in analyzing inertia

One of the main theoretical contributions of this dissertation consists of the analysis of policy and management inertia, in terms of problem statuses defined by the predictability of impacts and threats posed to livelihoods. To relay these statuses in a structured way, chapter 4 depicted them as a grid made up of two dimensions which result in four quadrants, as depicted in Figure 16. The four quadrants represent the status an environmental problem can have at one point in time, and in section 4.2.1, some examples of how environmental problems currently fit into this grid were discussed. Two main assertions were made regarding this grid. One, that for non-manifest problems, typical environmental management tools are unsuitable. Conventional stakeholder analysis and participatory action research approaches do not work, and chapter 3 and 4 offered alternatives. Two, these statuses are dynamic instead of inherent to a problem, meaning they can change over time: e.g., scientific progress might enhance the predictability of impacts, or changes in livelihoods could decrease or aggravate the threat a problem poses. In chapter 5, three trajectories between the problem statuses were illustrated, and below in section 6.3 suggestions for promoting such shifts will be made. But first, this typology is compared to other thinking in environmental governance on why certain environmental problems do get attention while others do not. Also, the implications of perceiving invasive alien species through this typology are discussed.

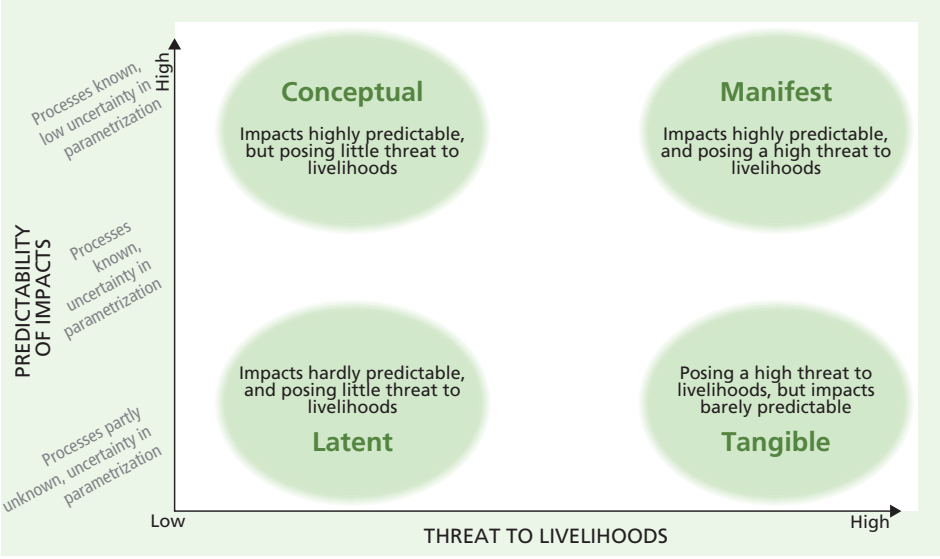


Figure 16. Typology of problem statuses for environmental problems, as defined by the predictability of their impacts on the vertical axis, and the threat they pose to livelihoods on the horizontal axis. This results in four quadrants, representing statuses an environmental problem can have at a given point in time.

6.2.4.1 Not every situation is a problem

The explanation as offered in this dissertation for the lack of action regarding Coralita despite it being considered a nuisance, revolves around the latent problem status it has on Saba and Statia. That is not to say that there are no other factors at play; it is not intended to be an exhaustive explanation for the inertia regarding Coralita. For example, daily practices and sticking points thereof in which Coralita is embedded, were discussed in chapter 4. But the idea that a latent problem status contributes to management and policy inertia, jointly hampering adjustments to Coralita's current manifestation, is novel. It is an important contribution to other theories such as Advocacy coalition theory or Punctuated equilibrium theory, which are used in political theory to explain why some problems attract attention and make it to the political agenda while others do not. The main difference between these theories and the problem status typology as presented in this dissertation, lies in the explanatory onus: instead of the actors and political arena dealing with the problem, it is on the characteristics of the problem itself. The perspectives are not mutually exclusive, so there is potential for integrating the thinking in terms of a problem's status with these political theories. How would these theories explain the inertia regarding Coralita, and what does the problem status thinking add to that?

Political decision-making is generally regarded a somewhat chaotic affair, depending more on who is paying attention to what when, than the costs and benefits of the potential decisions. Also, problems are considered to be a construct: they do not exist as such, but have to be defined first: "The difference between a condition and a problem is that the latter is seen as something that we ought to do something about (…)" (Knaggård 2015, 452). Why the situation of Coralita is not a problem, is explained differently by different theories. For example, Punctuated equilibrium theory, with as main authors Jones and Baumgartner (2005), looks at agenda-setting through the lens of winning and losing coalitions. Which coalition is the winning one depends on the image they propagate of "their" problem, and the venue in which problems are being addressed at that moment. They would thus say that Coralita is not on the agenda since the coalition that propagates an image of Coralita as a problem is on the losing end. Hence, it receives little attention from the people who are capable of putting it on the agenda.

Coalitions are also central to the Advocacy coalition framework (Sabatier and Jenkins-Smith 1993). They argue that people hold deep core beliefs and are arranged in coalitions according to their policy beliefs. These coalitions retain resources and power, and the policy beliefs of the coalition that holds most of these, dominate the political arena and get translated into policy action. Why Coralita does not get addressed would by this theory be explained as a an absence of it in the policy beliefs of the coalition that holds the relevant resources for addressing it.

Instead of coalitions, Multiple streams theory would point to Coralita being absent from the relevant streams. Kingdon and Zahriadis are prominent authors on this theory,

and distinguish between a problem stream, a policy stream and a politics stream. When these are connected on a certain topic, a problem ends up on the agenda. This can happen during what is called a policy window, and the connecting of streams is done by policy entrepreneurs. But first, a problem needs to be recognized, i.e., to feature in a problem stream. Some recent literature has zoomed in on the problem stream and how topics compete for attention therein. Whether a situation, condition or phenomenon becomes recognized as a problem, is something that happens in the problem stream. Mukherjee and Howlett (2015) contend that within the problem stream, epistemic communities exist, consisting of actors involved in delimiting and articulating problem spaces. Based on a shared interpretation of knowledge, an epistemic community shapes discourses and "(…) pursue[s] the translation of broad issues into distinct problems that policymakers can act upon (…)" (Mukherjee and Howlett 2015, 70). Knaggård (2015) ascribes this type of activities to one specific actor: the problem broker frames a condition as a public problem without promoting a specific solution. They aim to get policy makers to accept their framing, for which they require access, credibility and persistence. Reardon (2018) argues for a view of networks as developing, framing and sustaining ideas that facilitate and constrain the recognition of problems. Within a network, the dominant coalition develops an appreciative system, comprising factual and value judgements through which problems are perceived and delimited.

Through these lenses, Coralita may not be recognized as a problem for two reasons: because there is no problem broker, epistemic community or appreciative system that frames it as such within a problem stream; or because the Coralita problem stream does not get coupled with the other streams. The question that remains unanswered by each of these theories, is why that is not the case. This is where the thinking in terms of a problem's status makes an important contribution to environmental governance literature. The typology acknowledges that some situations are more likely to be recognized as problems than others. An environmental problem that has a latent status, is not very likely to be picked up by a problem broker or feature in the policy beliefs of the dominant coalition. Opposed to this, a manifest problem is much more likely to feature in a dominant coalition's policy beliefs or to get the attention of an epistemic community. This dissertation thus explains a phase preceding the purview of the theories discussed above. Next to these insights into environmental problems, what does this dissertation add to literature on invasive alien species?

6.2.4.2 Implications for conceptualization of invasive alien species

This thesis framed an IAS as a problem comprising two dimensions: the threat it poses to livelihoods, and the predictability of its impacts. This departs from conceptualizations commonly used in invasion literature, such as the barrier models presented by e.g., Blackburn et al. (2011) or Richardson et al. (2000). Chapter 5 discussed that the "invasive

alien" label does not so much give rise to action regarding invasive alien species, as it is an additional argument for acting. For the Asian tiger mosquito and the Egyptian goose in the Netherlands, their status as an alien was invoked to tighten the control. But the main incentive for controlling them, were the hazards they are from a health and infrastructural perspective, respectively. Thus, while the "invasive alien" label is reflective of an ecological reality, it holds little relevance from a governance perspective. For the governance reality of an invasive alien species, the two dimensions mentioned earlier are what mediate action: threat to livelihoods and predictability of impacts. Both dimensions will be discussed below and compared to common conceptualizations of IAS, starting with the threat posed to livelihoods.

Impacts of an IAS are generally what gives rise to research and governance efforts regarding a species, but are also highly contested. As discussed in chapter 1, both the ecosystem dynamics resulting in an impact and the subjective valuation of these, are fraught with ambiguity, uncertainty and knowledge gaps. To establish a threat posed to a community's livelihood, a very limited amount of information regarding the working of the ecosystem and the effect of the IAS on it, is needed. Rather, a basic understanding of the community's livelihood is required, which is most often readily available or fairly easily obtainable. For Coralita, knowledge on the impacts on nutrient cycles, water table and soil stability is lacking. But knowing the limited role of agriculture in livelihoods of the island communities suffices to deem Coralita a limited threat to livelihoods.

The second dimension of the dissertation's conceptualization of IAS, the predictability of impacts, makes the uncertainty surrounding most IAS an explicit part of its definition. Also, the profound character of that uncertainty, that is referred to as "ignorance" in risk literature (Liu et al. 2011), is stressed. Uncertainty surrounding IAS has long been acknowledged, but approaches to dealing with it assume that at least the suite of potential impacts is known. E.g., deliberative multi-criteria analysis (Liu et al. 2010, Liu et al. 2011) acknowledges uncertainties and ambiguities, but assumes that impacts can always be assessed and evaluated, and calls for citizen juries to weigh the uncertainties. This dissertation has shown an example of where the uncertainty is so profound, that no citizen jury is able to assess it in a meaningful manner. Similarly, other difficulties in dealing with the invasive species resulting from the high uncertainties were demonstrated, such as latent stakeholder perceptions and community inertia. Literature on IAS so far has not recognized the uncertainty regarding an IAS for the crucial dimension it is, which this typology aims to correct.

By combining these two dimensions, threat to livelihoods and predictability of the impacts, the typology presented in this dissertation judges a species by its status as a problem: latent, manifest, or somewhere in between. Latency was linked to management and policy inertia, while a manifest status appeared conducive to action. Regarding an invasive alien species with a latent problem status, stakeholder positions can therefore

be expected to be unclear, and inertia regarding policy and management expected to exist. How to deal with this was discussed in chapter 3 and 4, which will be reflected on in the next section.

6.3 RESOLVING THE LACK OF ACTION

The research aim of this dissertation was not only to explain the lack of action regarding Coralita on Saba and Statia, but also to provide ways of resolving it. Although already touched upon in several of the chapters, the legitimacy of wanting to redeem that lack of action is worth mentioning again. For one, Saba and Statia are located in the Caribbean, and as such part of one of the world's biodiversity hotspots, with about 60% of the region's 12,000 plant species being endemic (Mittermeier et al. 1998, Kairo et al. 2003). Secondly, invasive alien species (IAS) are, after habitat loss, the second biggest threat to biodiversity (Pejchar and Mooney 2009). This threat is even higher on islands, since insular ecosystems are particularly fragile, and IAS are claimed to be more likely to establish successfully and have a more devastating impact, there (Kairo et al. 2003, Reaser et al. 2007). Although the specific dynamics are challenged (e.g., Sax 2008, Vilà et al. 2011), this is definitely cause for vigilance. Thirdly, preventive action regarding IAS is regarded as the most effective and the least costly approach (Russell et al. 2017). One estimate even contends that every dollar spent on prevention, saves 17 dollars in later measures (Davies and Sheley 2007). Jointly, these reasons make a lack of action regarding IAS on Saba and Statia worrisome, and legitimize attempts at resolving the inertia. This dissertation does not aim for a specific course of action, but for anything other than not-acting by default. As discussed in chapter 4, inertia regarding Coralita is not the result of a conscious choice not to act, but emanates as a corollary to land-use practices. In light of the large potential impacts of the vine, deliberateness in dealings with it should be strived for. This dissertation offers handles for that, addressing the explanatory dynamics expounded in section 6.2.3 and Figure 15 in several ways:

- The polycentric governance configuration can be improved based on the findings relayed in chapter 2, foregrounding the division of responsibilities and budget;
- How to make latent problem perceptions explicit was shown in chapter 3, through a combination of Q methodology and a landscape value typology. This way, stakeholders regarding a latent problem can nevertheless be identified;
- The problem status of Coralita on Saba and Statia could be moved from latent towards manifest, for which chapter 5 described trajectories applicable to invasive alien species in general. Also, chapter 4 showed how through PAR-L, a latent problem can be addressed as a corollary to a manifest problem;

- The daily practices were addressed during the PAR-L process in chapter 4 as well, and recommendations for enhancing that on Saba and Statia will be made in chapter 7.

The recurring topic here is Coralita's latent problem status, which as depicted in Figure 15 feeds into both the policy and management inertia. Changing that problem status would presumably redeem these inertias. This section looks into two approaches to lifting Coralita's latency, in concordance with the two axes of the problem status grid (see Figure 16), which places Coralita at the bottom of a vertical axis representing the predictability of impacts, and at the left end of a horizontal axis representing the threat to livelihoods (see Figure 16). Following the logic of this grid, efforts should be directed at maximizing the predictability of the impacts and the threat posed to livelihoods. In this section, suggestions will be done for how to go about this, starting with the vertical axis.

6.3.1 Enhancing predictability of impacts

To enhance the predictability, i.e., move an environmental problem up along the vertical axis, two elements are important: the additional data needed to enhance predictability, i.e., content of remaining knowledge gap; and the type of knowledge required. Regarding content, ideally whatever knowledge gaps regarding processes and parameters exist are filled. Research efforts would be such that full impact and risk assessments can be completed, such as Harmonia^{+} (D'hondt et al. 2014) or SEICAT (Bacher et al. 2017). However, before embarking on a comprehensive data-gathering campaign, some considerations regarding the type of knowledge required should be addressed. Within IAS literature, researchers increasingly stress the need to broaden the scope of the knowledge that is produced, arguing that objective ecological science is not the only type required (e.g., Larson 2007). Since invasive species have impacts on people and managing them can have impacts too, scientists cannot refrain from participating in deliberations involving value judgements. Disregarding socio-political context, or unidirectional communication have been found to foster conflict (Crowley et al. 2017), and knowledge produced needs to fit a community's value systems (Moon et al. 2015). Byers et al. (2002) provide an example of the Zebra mussel, arguing that despite the large body of scientific literature available, nature managers were not prepared for dealing with the invasive species. In the field of climate change, this has been dubbed the 'climate information usability gap' (Lemos et al. 2012). Yet, despite the growing call for socially relevant science, IAS studies remain predominantly focused on ecological data (Estévez et al. 2015). Knowledge gathering efforts to enhance the predictability of impacts should thus move beyond purely ecological data and involve the societal context in which management would take place, to prevent a mismatch between scientific knowledge and political reality.

A helpful perspective on this might be offered by the three characteristics of effective information regarding environmental themes, as distinguished by Cash et al. (2003): legitimacy, credibility and salience. Credibility is dependent on scientific soundness of the data and reasoning; legitimacy on representing stakeholders' divergent values and beliefs and being unbiased in its conduct and fair in its treatment of opposing views; salience is the relevance of the information to the decision makers (Cash et al. 2003, Van Enst et al. 2014). Just like Van Enst et al. (2014) linked these different types of knowledge needs to different interaction problems between science and politics, they can be linked to the four problem statuses distinguished in this dissertation. For a latent problem, all three types of knowledge are lacking. When focusing knowledge generating efforts on credible knowledge such as purely ecological data, the problem evolves from being latent towards conceptual. When mainly gathering legitimate data, for example on stakeholder positions, the problem moves towards a tangible problem status. When gathering both legitimate and credible knowledge, the problem status of an environmental problem moves from latent to manifest. However, additional salient information, i.e., information that fits policy processes, remains needed as long as the problem exists. Data-gathering efforts should thus aim to gather all three types of data.

But, if the research setting is such that the lack of knowledge cannot be redeemed within the span of the project, as was the case for this dissertation, chapter 3 suggested how to work around that knowledge gap. The approach comes down to circumventing the lack of knowledge regarding Coralita's impacts by focusing on hypothetical impacts. Participants articulated their views regarding hypothetical impacts of Coralita, eliciting stakeholder groups based on potential impacts of the vine. For this, interviews were conducted using Q methodology and a landscape value typology that informed the statements presented to the participants. By discussing hypothetical impacts, the low predictability of Coralita's impacts contributing to its latency was circumvented. This allows for the identification of stakeholders and contributes to lifting policy inertia.

Solely moving up along the vertical axis can advance a latent problem towards a conceptual problem status. However, as illustrated in chapter 5, a manifest problem status is more conducive to action. The next section will therefore look at how to achieve movement along the horizontal axis, i.e., towards a tangible problem status.

6.3.2 Enhancing link with livelihoods

The horizontal axis of the problem status grid (Figure 16) depicts the threat a species poses to a community's livelihoods. To move along the horizontal axis, a threat does not need to be created in a physical sense, but by adjusting the problem frame. In chapter 4 an approach for doing so, PAR-L, was designed and illustrated. This approach starts by shifting focus to a more manifest problem, with links to the latent problem. The project should then be designed in such a way that when addressing the manifest problem,

the latent problem is addressed as a corollary. In chapter 4, by addressing the manifest problem of agriculture, the latent problem of Coralita was dealt with simultaneously.

Alternatively, an effort could be made to gather more stakeholder-relevant, i.e., legitimate knowledge, regarding the topic at hand, as discussed above. When aiming for a shift along the horizontal axis of the problem typology grid, instead of research into ecological questions, matters that are of interest to the community could be researched, such as the best management methods regarding Coralita, or specific potential impacts of the vine that people find explicitly worrisome, as identified in chapter 3. Such legitimate knowledge would award Coralita more of a tangible problem status, rather than a latent problem status. Moreover, when evaluating the pilot conducted in chapter 4, participants indicated the need for such research efforts, to address knowledge needs that became apparent during the pilot. The tailor-made character of PAR-L projects renders them very suitable for incorporating research efforts, for example via approaches such as joint knowledge production (Hegger et al. 2012) and socially robust science (Seijger et al. 2016), that facilitate the involvement of stakeholders' questions, knowledge and interests into scientific efforts.

The reasoning behind aiming for a more manifest problem status, is that involvement of stakeholders is easier for a manifest problem than a latent one, since there is more at stake for them. Which also means that conflicts may arise, when stakes are contradictory. Chapter 5 showed how conflict indeed increases for a manifest problem, but action as well. The conflict that arose was even partially due to the type of action undertaken, and not solely regarding opposing stakes. Thus, when moving along the horizontal axis towards a tangible or manifest problem status, arrangements to deal with conflict should be made. As mentioned in chapter 1, approaches such as community-based polycentricity and co-design are touted within invasion science as best capable of facilitating opposing stakes and building the social capital required to deal with these (Marshall et al. 2016, Shackleton et al. 2019). In a way, PAR-L is even more stakeholder-centered than such co-management approaches, since the community decides on the topic that will be the focus of the co-management efforts. Thus, PAR-L should be well capable of dealing with contradicting stakes, should any arise when a latent problem moves towards a manifest status.

In sum, changing the problem status of an environmental problem from latent to conceptual or tangible, could take shape as a PAR-L project with an explicit research component. The research should generate knowledge that increases the predictability of impacts of the problem, but is relevant to the community as well. Focusing on hypothetical impacts of the problem and linking with extant problems that pose a threat to livelihoods, was shown in this dissertation to lift a community's inertia, despite the latency of a problem.

6.3.3 Scientific contribution in resolving inertia

In addressing the second part of the research question – on how the inertia regarding Coralita on Saba and Statia can be resolved – lies another theoretical contribution of this dissertation. Namely, to link inertia to the status of a problem and frame the resolving of inertia also in terms of changing the problem status. This differs from conventional approaches to resolving inertia, which typically focus on adjusting perceptions or raising awareness. For example, Sullivan et al. (2017) speak of how trust should be enhanced, so resource users and government actors will be better capable of managing the invasive mile-a-minute weed (*Mikani amicrantha)* in Nepal. To enhance trust, the authors recommend addressing issues that directly affect the resource users' daily lives. But what if the issue that needs addressing does not affect the community's daily lives? This dissertation argues for targeting a problem's status in order to resolve inertia, rather than the actors refraining from acting. To do so, a problem can be made more manifest, or focus can be shifted towards a problem with a more manifest status, as discussed earlier. The benefit of this approach is that it harnesses extant inclinations towards acting, rather than trying to break through resistance. It shifts the purpose of a project from getting people to act on something they do not care about, towards something that does interest them and regarding which stakes exist to build on. The suggestions for how to do that, constitute two methodological contributions of this dissertation: the use of Q methodology combined with a landscape value typology, and the PAR-L approach. Both were explicitly designed for dealing with inertia regarding a latent problem, but some of their characteristics can be helpful in other cases as well.

6.3.3.1 Methodological contribution: Q methodology

To resolve the latency of stakeholder perspectives, stakeholder perceptions regarding a phenomenon linked to the issue of interest were elicited. As discussed in the analysis of inertia regarding Coralita, one of the contributing factors to policy inertia are these latent stakeholder perceptions (see section 6.2.1). Chapter 3 addressed that issue, analyzing that the lack of knowledge regarding Coralita hampered the articulation of opinions regarding the species, resulting in an absence of clear stakeholder groups. A creative approach was developed to elicit stakeholder perspectives nonetheless, by conducting interviews employing Q methodology regarding landscape values. Regarding these landscape values, participants do have manifest perspectives, as well as regarding hypothetical impacts of Coralita on these values. Thus, three perspectives on potential Coralita impacts were elicited for each island, that can be built on for stakeholder involvement efforts. This way, the policy inertia can be resolved.

Q methodology is typically used to map discourses, reveal value patterns or build a shared value system (Ellis et al. 2007, Webler et al. 2009, Gruber 2011, Uittenbroek et al. 2014). Combining Q methodology with a landscape value typology, and using it to elicit

latent perspectives is a methodological contribution of this dissertation. Q has been applied to reveal peripheral perspectives (Zabala et al. 2018), but never to elicit latent perspectives as done in this dissertation. For all cases where stakeholder perceptions are latent, whether resulting in inertia or not, this approach is applicable.

6.3.3.2 Methodological contribution: PAR-L

As discussed in section 6.2.2, a second corollary from Coralita's latent problem status is management inertia. Low threats posed by Coralita to the islands' communities limits reasons for them to adjust the configuration of daily practices that result in Coralita's current manifestation. Just like with Q methodology, the approach here is to address Coralita by proxy, in this case through an adjusted version of participatory action research for latent problems, called PAR-L. Tools such as participatory action research (PAR) have been applied successfully to environmental problems on the community level, e.g., regarding the depletion of fish stocks (Apgar et al. 2017) or disputes about land-use (Valencia et al. 2012). PAR's strength lays in co-creating knowledge, strengthening social networks, generating shared visions and reaching compromises (Trimble and Berkes 2013, Trimble and Lázaro 2014, Apgar et al. 2017). However, PAR generally focusses on manifest problems, which implies conflicts that need to be resolved. But whereas manifest problems come with conflicting stakes that matter to a community, latent environmental problems are characterized by a community's inertia in dealing with them. What this leaves PAR to deal with is not a conflict between highly relevant stakes for PAR but a community's inertia, which is what an adjusted version of PAR was developed for in chapter 4. To resolve the inertia, it addresses a manifest problem with the latent problem as corollary. This approach can be useful for other cases of inertia as well, whether due to latency or not.

Both methodological contributions focus on what people are interested in and ensures their participation by addressing that, rather than trying to get people to act on a topic they do not feel concerned about. In the practical recommendations of chapter 7, these methods will feature again. But first, some reflection on the research setting of this dissertation is in order.

6.4 CONDUCTING RESEARCH IN THE CARIBBEAN: SMALL AND PERSONAL

In the first chapter of this dissertation, the research setting was briefly discussed as a contextual feature of the case focused on: the dealings of a community with Coralita comprised the case researched, which happened to be set on two small Caribbean islands. However, that research setting had some repercussions for the research conducted, due to two main characteristics: the small scale and the Caribbean culture of

Saba and Statia. The implications of these characteristics on the research and how that was dealt with, are discussed in this section, starting with the small scale of both islands.

6.4.1 Implications of the small scale

The most conspicuous characteristic of this dissertation's study area is the small scale. Saba and Statia have a territory of 13 and 21 km^2, and communities of 2200 and 3300 inhabitants respectively (CBS 2018). What does this imply for the representativeness of the research findings? On the one hand, the small scale of the islands and their history of relative isolation result in a significant idiosyncrasy of Caribbean islands (Crawford 2007, Hillman and D'Agostino 2009). The findings in chapter 4 regarding practices of the Saban community that result in Coralita's current manifestation, can therefore not be assumed to exist on any other Caribbean islands. But the typology of problem statuses derived in that same chapter is applicable to all types of environmental problems, irrespective of where they occur. Also applicable to other locations are the methodological contributions of chapter 3 and 4, regarding Q methodology and PAR-L. The Coralita case on Saba and Statia served merely as an illustration of these approaches, which were designed to be applicable to other cases as well.

The small scale has some methodological advantages. For one, gathering a representative sample of the population is more readily achieved, partly because the amount of people needed to get a representative sample is lower. But also, and this was advantageous for chapter 3 in particular, since it is easier to know the full breadth of opinions present in a community, and to find representatives of them (see Ens et al. 2016). Moreover, actors normally hard to reach are more easily contacted, such as higher government officials. This enabled for example an interview with Statia's then-governor, for chapter 2. And just like the small scale allows for getting a complete picture of the community's perspectives, it also enhances the understanding of the dynamics at play regarding Coralita. The thoroughness of the analysis of daily practices in chapter 4 and the political dynamics in chapter 2 have definitely benefited from this.

An unavoidable implication of conducting research within such small communities for an extended period of time is the footprint left by the researcher on their research subject. The fieldwork for this dissertation spanned three years in total, and the attention drawn to Coralita during that period can be assumed to have had an impact on the local community. As for methodological consequences, the willingness of people to participate in the PAR-L pilot of chapter 4 may have increased following earlier fieldwork campaigns. But since measuring willingness to manage was not a purpose of that chapter, this does not matter. For chapter 3, the relative ranking of Coralita-statements may in theory have been affected by the attention of earlier fieldwork; however, the earlier fieldwork campaign had only lasted one week per island, so its impacts were most probably minimal. Next to methodological implications, the researcher's footprint

raises some ethical questions. However, given the unanimous dislike regarding Coralita that was already present on the island, potential management-encouraging effects of fieldwork could have had little negative impacts.

Lastly, the small scale necessitated some privacy-ensuring measures for the participants at a few instances. For chapter 2, the interviews addressed the delicate topic of governance relationships between The Hague and the islands. And for chapter 4, the participants of the PAR-L pilot were asked to evaluate the social dynamics during the project, but also regarding land-use on Saba in general. To ensure that people felt comfortable to speak freely, interviewees were anonymized in chapter 2, and in chapter 4 evaluation questions were posed during one-on-one interviews rather than focus group sessions. But despite these arrangements, a certain personal dimension can never be fully excluded from the research setting at a scale so small. In the next section, some Caribbean cultural characteristics affecting the research will be looked at as well.

6.4.2 Caribbean island setting

The idiosyncrasy of Caribbean islands in terms of e.g., their history, migratory dynamics, geopolitics and economies, grant them ample scientific attention. For the Dutch islands, authors like Oostindie, Veenendaal and Guadeloupe have addressed these matters extensively, to which this dissertation does not aim to add. But, some characteristics of Caribbean islands in terms of cultural and political dynamics have certainly affected the research conducted, which will be discussed here.

Every research setting comes with cultural characteristics, as is increasingly recognized within the scientific practice. Differences between cultures have for example been acknowledged in the field of international relations, where Meyer (2014) categorized differences across eight work-related dimensions. For example, whether confrontation is avoided, or sought after; whether trust is task-based or relation-based; and whether time is perceived in a linear or circular way. She distinguishes these differences on the level of nations, whereas anthropologist Mary Douglas' Cultural Theory distinguishes four types of "cultural biases" at the level of every institution (Douglas 1999). As for islands, the dependency on international trade, vulnerable economies, and relative isolation, is argued to give rise to "islandness": a strong sense of place and belonging, and a strong identity focused around shared hardship and historic self-sufficiency (Coulthard et al. 2017). Some have even tried to approximate differences between islanders and mainlanders in terms of the Big Five personality test, for example in terms of openness to new experiences (Camperio Ciani et al. 2007, Crawford 2007). Taking a stance on this would be far beyond the scope of this dissertation, but the main point is that the research setting of a Caribbean island comes with specific cultural dynamics, which should be taken into account when conducting research.

Concerning the Caribbean islands that are part of the Dutch kingdom, the differences in style between Caribbean politicians and their counterparts from The Hague receive much attention. Henk Kamp, a former Dutch minister and Kingdom representative, plainly stated that for Dutch politicians following a plan step by step is paramount, whereas on Bonaire improvisation and building relations is more important (Kamp in: Schoenmaeckers 2010, 30). Similarly, looking back at the decades-long process that resulted in the constitutional changes of 2010, Oostindie and Klinkers (2012) refer to Boeli van Leeuwen, the Curaçaolanean writer and statesman. Van Leeuwen described the negotiations between politicians from The Hague and the Antilles as half of them playing chess, and the other half dominos: the rules of the game differ entirely. Former governor of Bonaire, Glenn Thodé, puts it differently: the Dutch dance to house, Bonaireans to the bachata; two completely different rhythms (Thodé in: Schoenmaeckers 2010, 30).

The research of this dissertation was mainly affected in one way by the cultural context of the Caribbean islands: the importance of personal relationships over formal ties. Mulder (2016) describes the importance of family and neighbors on Saba, and how these weigh heavier than formal institutions such as the government or professional hierarchies. Explanations for this have been sought in the Caribbean islands' history of colonization and isolation (e.g., Oostindie 2000), making the communities of Saba and Statia mainly rely on themselves. During fieldwork, the importance of participating in island society and building personal relationships with people was quickly noticed. To that end, outreach, educational and volunteering activities were undertaken during each fieldwork campaign. By engaging with the local community in this way, improved understanding of the practices as discussed in chapter 4 was gained, and personal relationships were developed which allowed further research activities. While for the interviews in chapter 2 regarding the governance configuration most interviewees were approached based on their formal position, personal connections were needed for chapter 3. The interviews in that chapter required representatives of the breadth of opinion within the island communities, and were thus mainly recruited via personal connections using the snowball method. Locals met during church services or at community events were asked for participation, and they offered connections with other potential interviewees. Next to engagement activities, the importance of personal connections was also aimed to cater to by conducting research relevant to the local community. Hence, the interview set-up of chapter 2 and 3 was departed from in chapter 4, to make way for a participatory research approach that explicitly aimed to make positive changes to daily Saban practices.

Engaging with the local community in such ways offers a challenge to the need to maintain a degree of objectivity commonly sought after in science. Moreover, it can exacerbate the earlier mentioned impact of a researcher on its research subject. But the conventional image of science being conducted separately from society and striving

for objectivity, is increasingly challenged by perspectives such as post-normal science (Funtowicz and Ravetz 1993). Action research explicitly argues in favor of close collaboration between researcher and researched, and this was built on in chapter 4. Moreover, as was argued at multiple instances, society and IAS cannot be seen separate from each other, and the problem status typology proposed has explicitly social dimensions. The engagements with the local community were therefore both reflective of Saban and Statian reality, and conducive to the research.

6.5 SUGGESTIONS FOR FUTURE RESEARCH

This dissertation introduced a problem status typology, and linked it to policy and management inertia. While chapter 5 confirmed that general link to exist, it was mostly derived from observations regarding one specific case, and the dynamics behind it require more research. Does a latent problem status necessarily mean inertia on the part of the community, or are there examples where people are nevertheless involved in management efforts? Also, a vicious cycle between an absence of stakeholders and policy inertia can be expected to exist: this dissertation framed absent stakeholders as contributing to policy inertia, and therefore aimed to identify stakeholders. But the reverse might work too, as the development of policy will most likely prompt opinions and thus the appearance of stakeholder groups. Additionally, it can be expected that management and policy inertia reinforce each other, and that practices such as discussed in chapter 4 mediate the relationship between problem status and inertia as well. Chapter 5 pointed towards the type of impacts of an invasive alien species as important for whether action occurs or not, and there may be other dynamics involved. The interplay of problem status with other factors influencing the occurrence of inertia is worthwhile researching further.

Regarding the encouragement of action, participatory action research appears very promising, but questions remain regarding the larger scale and long term potential. The people involved with PAR-L in chapter 4 were those who care about the Coralita issue and are willing to put effort into projects regarding land-use. Is PAR-L versatile enough to cater to everyone's interests, and still reach the aim of lifting inertia regarding Coralita? Also related to PAR, the influence of external conveners should receive more attention: chapter 4 discusses the leadership of the researcher as crucial to the project's success, so what is the durability of such projects (see Barnes and van Laerhoven 2015)?

A knowledge gap that kept coming up throughout the research as key to the Coralita issue, is the low predictability of the vine's impacts. Inherent to the definition of a latent problem, is the limited predictability of the problem's impact, for which this dissertation offered avenues to work around. Although linking the latent problem to a manifest

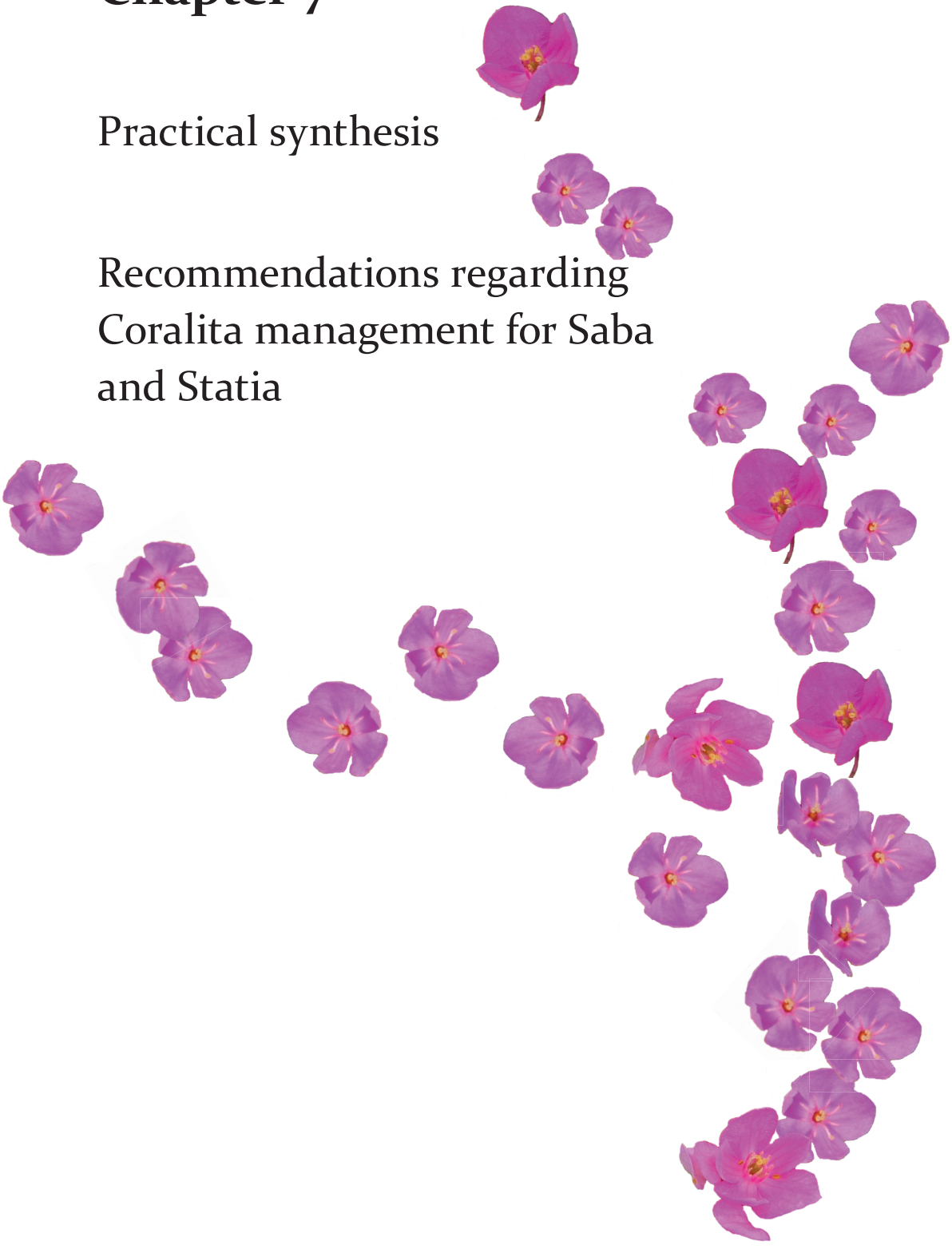
problem showed potential to redeem inertia, more ecological knowledge regarding Coralita is needed to inform management measures. Thus, increasing understanding of the vine's impacts would certainly be a valuable direction of future research, which can build on Sweeney's (2018) work that links Coralita's characteristics to Saba's ecosystems and gauges potential damage from that.

Lastly, the Caribbean context which was referred to earlier in section 6.4 prompts some remaining questions. As mentioned in chapter 2, the merits of a polycentric system may materialize differently in a Caribbean context. As Nauta (2011) suggests, the scale and history of Caribbean societies might call for a different division of governmental powers, and for a reconsideration of the general understanding that every public task can in theory be assigned to a local entity. Another aspect that would be interesting to research further is the way people relate to nature. Research into human-nature relationships has shown that differences across cultures exist (Duong and Van Den Born 2019), which for example can imply a lower tendency to control nature. Locals sometimes expressed a somewhat laissez-faire attitude towards nature, pointing out that in a hurricane-prone area trying to control your environment is a lost cause. This can be assumed to affect attitudes towards management of invasive alien species, and would make for interesting future research.

Chapter 7

Practical synthesis

Recommendations regarding Coralita management for Saba and Statia



Having synthesized the scientific findings of this dissertation and answered the research question in the foregoing chapter, a practical synthesis will be provided here. Which insights for Saba and Statia did this research accrue, and what would be recommendable for dealing with Coralita on both islands? This chapter is structured along the why, who, and what of Coralita management, and ends with a few spatially specific recommendations.

7.1 WHY CARE ABOUT CORALITA?

This dissertation put a lot of effort into understanding and attempting to lift inertia regarding Coralita – why? Because the vine is unwanted on large parts of Saba and Statia; because it threatens values of the landscape that are important to Sabans and Statians, and because invasive alien species are an infamous hazard. Figure 17 below shows all the areas where people do not want Coralita (in pink). This covers a large part of both islands, and both in nature areas and villages. Reasons why people dislike the vine were elicited in chapter 3, by asking about hypothetical impacts of Coralita. For both islands, three perspectives on the value of nature held by inhabitants were identified. Whether people look at nature mainly as a resource to use, or something that should be preserved for future generations – Coralita is worrisome to all. It should also be stressed that invasive alien species are regarded as one of the biggest threats to biodiversity by scientists, IUCN and the UN alike (Pejchar and Mooney 2009, IUCN 2018, Díaz et al. 2019). The nature on Saba and Statia is very beautiful and unique, and the damage Coralita can potentially do is enormous.

When starting management of Coralita, first deciding on why it needs to be managed is crucial. Whether the aim is to preserve nature or to prevent erosion has repercussions for the stakeholders involved and the areas focused on. The perspectives elicited in chapter 3 offer a good starting point to continue the discussion on priorities for Coralita management, especially in combination with the unwantedness maps shown above: who wants to contain it where and why? Once the priorities have been set, the involvement of relevant actors can start.

7.2 WHO SHOULD BE INVOLVED?

Who to involve can be decided on in two ways. One, by looking at the current use of an area. For residential areas, the home owners are of course central to the efforts. During a stakeholder meeting on Statia in November 2018, one participant suggested to group local residents into neighborhood taskforces, that would be in charge of dealing

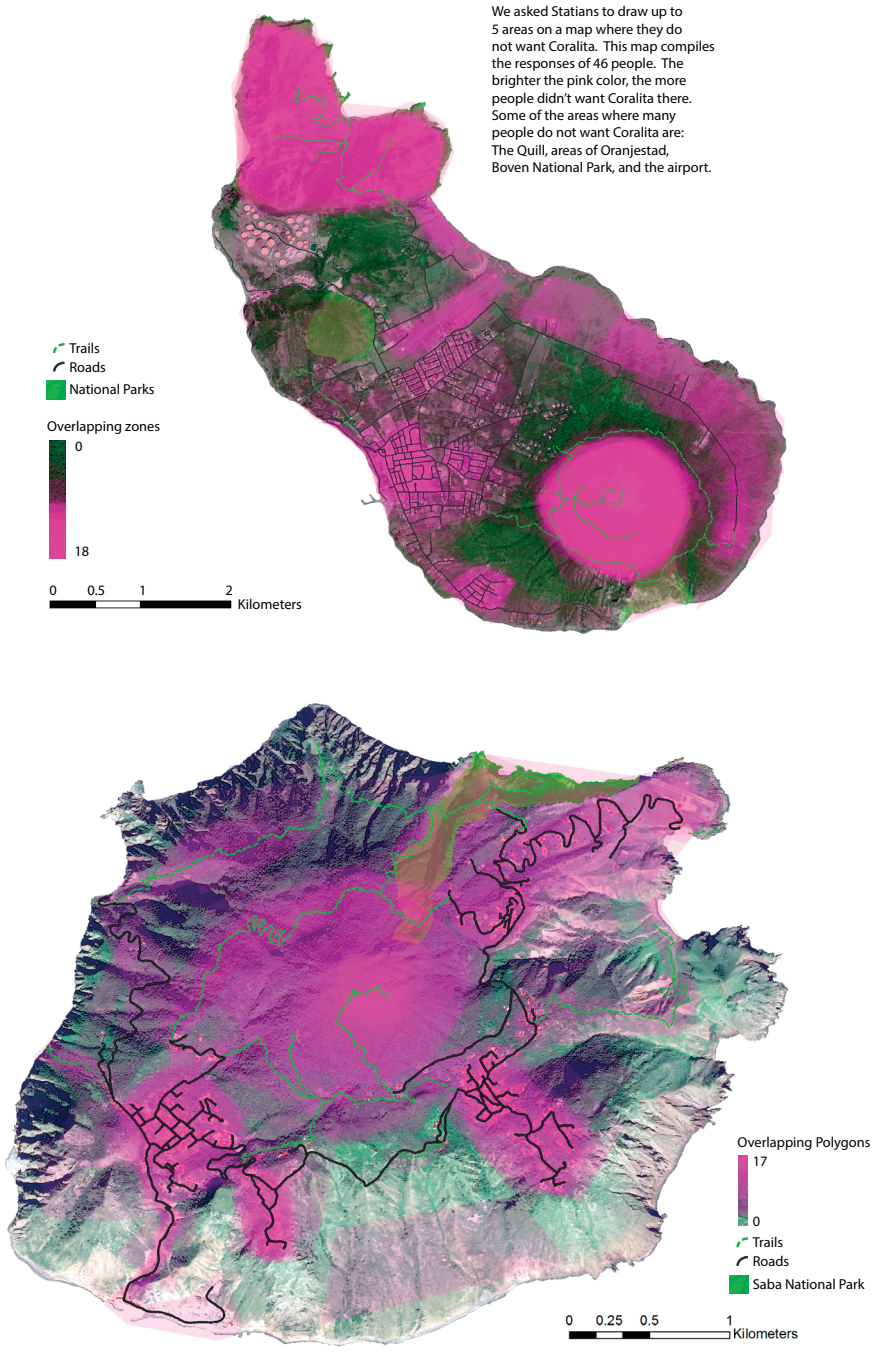


Figure 17. Below, areas where Coralita is unwanted on Saba, according to 50 Saban participants. Above, areas where Coralita is unwanted on Statia, according to 46 Statian participants. The brighter the pink, the more people selected that area. Data collected October 2016 – March 2017, processed by Elizabeth Haber.

with Coralita in that neighborhood. The taskforce could set-up projects akin to PAR-L as discussed in chapter 4, in which a Coralita-covered area was redesigned by the neighborhood. Second, who to involve can be decided based on the three perspectives on the value of nature per island elicited in chapter 3. For Statia, supporting cycles, the utility value of nature and biodiversity are themes that the different stakeholders worry about. Coralita's link with the former two topics is yet unknown, so requires further research. The smothering character of the vine does pose a clear threat to biodiversity, so a possible PAR-L project would be to prevent its spread to a specific area with high biodiversity value. On Saba, agriculture, biodiversity and aesthetics have the stakeholders concerned, so projects that focus on enhancing agriculture, on keeping the "unspoiled Queen" unspoiled and protecting biodiversity would get people involved.

Both islands have plenty of social capital to build on, for example the trail cleaning volunteers on Saba, and the "Statia at heart" group on Statia. Other ideas discussed with local government were to have school classes adopt a certain area or tree that they are assigned to keep free from Coralita. During fieldwork, a few clean-up events were organized by Elizabeth Haber and the author, which were participated in by locals. However, both these events and the PAR-L project of chapter 4 elicited the importance of an active project leader. The PAR-L participants all indicated that, despite their commitment and intentions, without the efforts of the project initiator, the project would not have reached very far. And no additional clean-up events were held, despite several people expressing their intention to do so.

Strong leadership to make sure activities remain on track is often mentioned in literature (e.g., Graham and Rogers 2017). This person should also be in charge of ensuring faith and trust between everyone involved. Crucial to successful management of invasive alien species is trust between everyone involved, and faith that the project can be successful. Faith of the community in the nature organization's expertise; of the latter in the former's willingness to cooperate; and of both in the government's resource-wise commitment is crucial for any invasive alien species strategy to work. Each island should thus have one person or organization heading a Coralita program, ensuring involvement of all relevant actors.

7.3 WHAT SHOULD ACTION REGARDING CORALITA ENTAIL?

The single most effective way to curtail Coralita's spread, is to use land. This clearly shows from its presence on former farming grounds, abandoned building sites or otherwise disturbed areas. When land is used for agriculture, gardening, or covered by native vegetation, Coralita has much less of a chance to take over. Moreover, it appeared much easier to get people to act when diverting attention from Coralita towards agriculture,

as described in chapter 4. The ongoing efforts to increase agriculture on Saba and Statia could thus be dovetailed with efforts to contain Coralita.

In any project developed, pragmatism and feasibility should be core design principles, given the limited resources on Saba and Statia. Moreover, a weariness regarding paper policy plans was frequently professed by locals, interviewees and governmental actors alike during fieldwork. This is nicely exemplified by Mulder (Mulder 2016), when quoting the Saban harbor master on his dislike for following protocol: "(…) You either work with local people, or you work without local people. Local people don't wait for no *overleg* [consultation]; they try to get things done." (Mulder 2016, 15). The aim should be to minimize the *overleg* and maximize the getting things done.

As a side note, should large resources become available for IAS management on Saba and Statia, elaborate guidelines for developing an island-wide invasive alien species strategy exist, for example the one developed by IUCN (2018). Conducting a risk assessment such as proposed by Koch et al. (2016), an assessment of (dis)services delivered by Coralita and the community's attitudes towards those as outlined by Lewis et al. (2019), and developing a stakeholder involvement strategy as suggested by Novoa et al. (2018) would surely result in a very thorough foundation for action. But these programs are all very lofty in their comprehensiveness, the resources and skills they require to be implemented and the full compliance they require in order to be effective. Therefore, more realistic suggestions for action are outlined in the next section: promoting community action, testing management methods, and designing an island-wide approach to Coralita.

7.3.1 Promoting community action to adjust daily practices

In section 7.2, some ideas for involving locals were mentioned, such as clean-up events and adopt-a-tree programs. An idea raised by stakeholders on Statia, was to establish a Coralita team per neighborhood. They could contain Coralita in public areas, and assist inhabitants in combating the vine in their yards. Such approaches work well for prevention and to clear small areas. But how to deal with the larger stretches of land covered in Coralita?

As mentioned earlier, using land is the most effective and cheapest way to contain Coralita. In chapter 3, the large amount of unused land is explained through the decline of agriculture, free-roaming goats and complex land titles. Breaking through these dynamics requires working with land owners throughout the community. More specifically, when stimulating gardening efforts on unused land, arrangements for water and fencing are required, as discussed in chapter 3. Assistance to private land owners in initiating land-use projects and arranging the required resources has the largest potential to contain Coralita. The project conducted in chapter 4 could serve as inspiration for that: a piece of land covered in Coralita was made available by the owner and a group of locals

designed a better use for it. Since the land was intended for communal use afterwards, people became enthusiastic about plans such as a fruit orchard or a petting zoo. Putting effort into Coralita removal is much less of a deterrent when the final aim is to create something attractive and available to everyone. Next to that, showing that Coralita can be contained and how much nicer an area becomes, works as a motivation for people. Repeating this kind of projects in which Coralita removal is a corollary of enhancing agriculture, tourism, or another theme that directly impacts people, is recommended. This can be applied both on communal areas, but also as an approach to individual land owners. A core team of Coralita enthusiasts, who approach land owners, gather participants and offer support in arranging the required resources should head such a project; this could also be the earlier mentioned neighborhood taskforce. But how to remove Coralita from project areas?

7.3.2 Test area for management methods

The one thing that is clear about Coralita removal methods, is that the earlier, the better. A young sprout of the vine can still be easily removed, whereas if allowed to mature, the roots and tubers will grow deeply and firmly into the ground. Thus, immediately pulling it out, or repetitive mowing is best. Once the vine has already settled, little is known about the best management methods.

Throughout fieldwork this knowledge gap kept being mentioned by locals as demotivating them to undertake action. The effectiveness of methods such as mowing or digging have not been tested consistently, and not knowing for certain it will have effect, people do not feel the large effort it takes is worthwhile. Local approaches include RoundUp and even pouring diesel on the plant, which is highly detrimental to the soil, and can have far-reaching effects through run off. Therefore, a very important project would be to systematically and well visibly to the local community, test different methods. For each method, the resources (time, skills, material, finances) required, and the results (change in cover, time before the vine returns) should be kept track of. To properly test these methods, a project period of about 5 years would be needed, with continuous close-up monitoring. When doing this on a plot somewhere easily accessible to locals, proper outreach activities can be organized to enhance the uptake of the experiments' results. Management methods that should be tested, are:

- The planting of Vertiver grass or Elephant grass, which is especially held in high regard by one of the main rangers of Saba. The risk of this approach is of course for these grasses to become invasive as well, like happened with *Spartina anglica* in the Wadden Sea (Nehring and Hesse 2008), which should definitely be addressed in such research. A succession-approach of mowing Coralita, and planting native species simultaneously with the grass to hamper regrowth, could be tested. Does the grass

indeed hamper regrowth, does it behave invasively itself and how long is it needed before native species can take over?

- Fencing in goats and pigs on a Coralita area. Goats sporadically nibble on the vine, but it is clearly not their preferred source of food, which is why in chapter 4 the practice of free roaming goats is identified as exacerbating the Coralita issue. Yet, fencing them in might change this, and some experiments in which the animals' wellbeing is safeguarded would definitely be worthwhile. Pigs are known to dig up the tubers that make the vine so persistent, but the question is how thorough they are and for how long an area remains clean. Well designed, long term tests in which both the degree and the duration of the clearance are researched could result in an approach that takes little effort, and in the case of the goats, that solves two problems at once.
- Using shade to hamper Coralita growth, building on the student project done on Saba (Planas i Puig 2018). This could be done with tarp or through natural shade cast by trees or shrubs, which is known to work. But here too, the degree of eradication achieved and the duration thereof is not known, nor how shady it needs to be for these effects to occur.

7.3.3 Island-wide approach

Coralita spreads both by growing, and by seeds or branches being dispersed by the wind. Therefore, all of Saba and Statia is vulnerable to Coralita, and at the same time key to containing it. If one area is neglected or one land owner denies cooperation, the rest of the island experiences the consequences. Thus, aligning Coralita management across the whole island is crucial. Therefore, three things are important:

1) Assigning budget, responsibilities and mandates. Chapter 2 discussed how the somewhat obfuscated division of mandates and responsibilities, compounded by a lack of corresponding budgets as perceived by the islands, add to policy inertia. To arrange the leadership necessary for all the elements mentioned above, a clear division of responsibilities is crucial. A new Caribbean nature policy plan is supposed to be established for 2020-2025 (Ministerie van BZK 2019), and this time the concomitant island-level policy plans should be realized. These plans should assign responsibilities, mandates and budget to island-based institutions for specific areas or measures regarding Coralita, such as the ones mentioned above. More specifically, Coralita should be included in trail management, and budget made available for that. Also, reference was made several times to a neighborhood taskforce, heading projects to clear Coralita in the neighborhood, and to assist land owners in managing Coralita on their land. Resources to assist with fences and water should be made available for that purpose.
2) Knowing where Coralita is present. Elizabeth Haber is working with satellite imagery to establish Coralita's presence, which has proved less suitable for frequent monitor-

ing purposes. Drones may be able to capture useful images. Monitoring Coralita's spread twice a year should be sufficient to assess whether it is spreading, and to indicate areas to focus additional management measures on.

3) Deciding on Coralita management goals per area. Ideally, Coralita would be fully eradicated from the islands, but this is very costly and hard to attain. Therefore, priorities should be set (see section 7.1) and focus areas selected accordingly. For example, to preserve native and endemic species, on Saba everything above 500 meters should be declared Coralita-free, as well as a five meter buffer zone along the trails. On Statia, the Quill, Boven and White wall could be assigned as Coralita-free areas, meaning that the vine will be removed as soon as it is spotted there. Area selection could be based on the value of that area, for example by establishing that Coralita should be kept out of all areas with a touristic value. Alternatively, a potential impact of the vine and the areas that are vulnerable to these impacts could be focused on. For example, erosion risks were mapped for both islands, and based on that, recommendations can be made regarding where to remove and where to leave Coralita untouched. In section 7.4, some specific recommendations on where to undertake what regarding Coralita are presented. These were also made to stakeholders on Saba and Statia during October and November 2018.

7.4 SPATIALLY EXPLICIT RECOMMENDATIONS: PRIORITY AREAS

In October 2018, Elizabeth Haber, Jetske Vaas and Martin Wassen met with stakeholders on both islands to relay research findings and make recommendations for management. The 25th of October, they met on Saba with the Island Governor, members of the Island Council, and rangers of Saba Conservation Foundation. The 30th of October, they met on Statia with the Deputy Government Commissioner, Stenapa and LVV. The recommendations made then are included below.

7.4.1 Priority areas for Statia

Bare areas are ideal for Coralita to spread, such as along the Slave path and the trailhead at Upper round hill (see Figure 18 below). Planting native vegetation there will give Coralita less of a chance to take over.

There are some spots where Coralita is creeping up the Quill, such as the trail head at Rosemary lane, the road to the Radio tower, and at the trail head of Upper Round Hill (see Figure 19). For these areas, reforestation and removal of the vine should be combined, to keep it from spreading higher up the Quill. To that end, Coralita should be part of trail management, so it can be spotted and removed as soon as possible, which is the easiest and cheapest way to keep it in check.

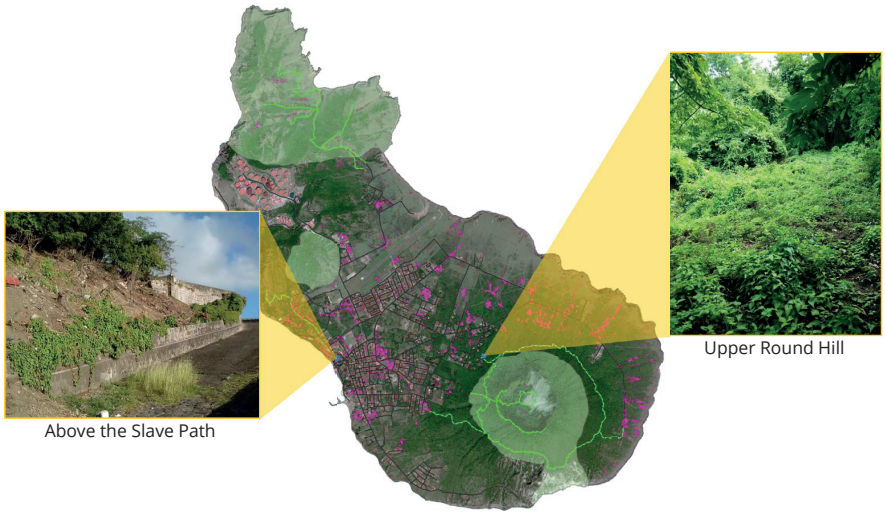


Figure 18. Recommended restoration and reforestation areas on Statia. The national parks are highlighted in green, and the pink areas depict where Coralita is present according to Elizabeth Haber's model (2018).

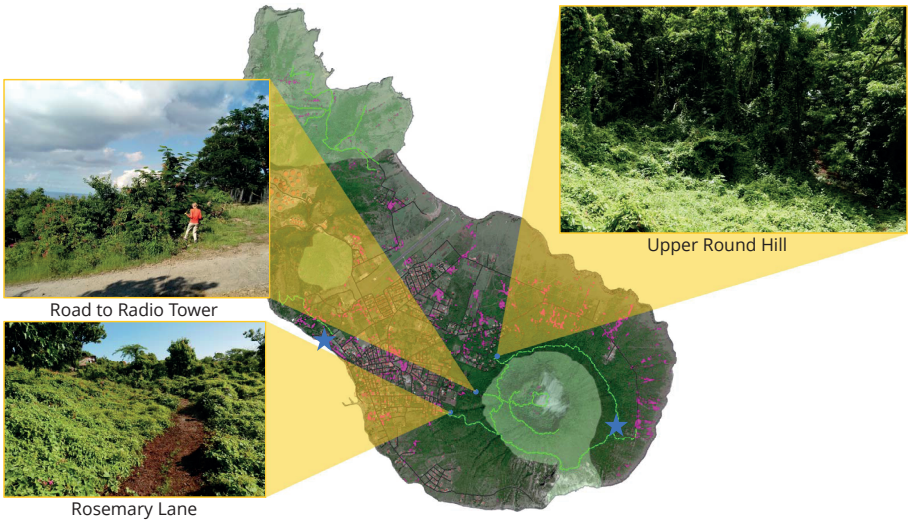


Figure 19. Recommended removal and reforestation areas on Statia. The national parks are highlighted in green, and the pink areas depict where Coralita is present according to Elizabeth Haber's model (2018).

There are some areas where Coralita should be monitored closely, namely Fort de Windt and Boven (see Figure 20). At White wall there are some small specks of Coralita, and the gullies could be channels for the vine to spread. In the Venus Bay gully, it does not seem to be present yet, but here too the gully could be a moist place for the vine to settle.

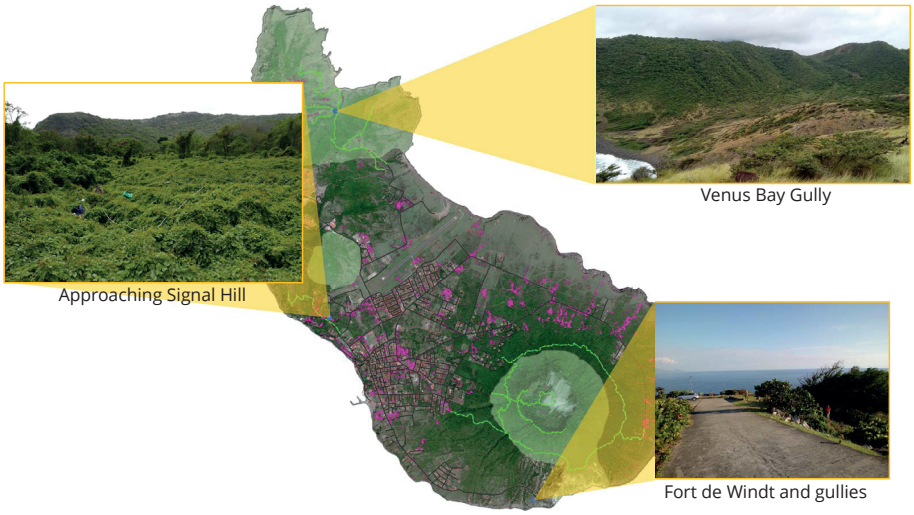


Figure 20. Recommended monitoring areas on Statia. The national parks are highlighted in green, and the pink areas depict where Coralita is present according to Elizabeth Haber's model (2018).

Erosion was spoken about as well, which is a major concern for the Statia cliffs. Trees and shrubs have a much more elaborate root system than Coralita, and therefore are preferable over Coralita. However, compared to nothing, Coralita at least hampers heavy rains from washing away the top soil. Coralita should thus be prevented from spreading to cliffs that currently have native vegetation, which makes the large stretch of Coralita below Signal Hill worrisome. The stakeholders met with on the 30th of October all agreed that a buffer zone, free from Coralita, is needed below Signal Hill, to keep it from spreading into the park. The cliffs of Corre Corre Bay are covered with Sea grape, which is a very good erosion preventing and native species. And it happens to produce grapes that birds and people alike can enjoy. Therefore, Sea grape should be planted above and on cliffs, to prevent erosion.

7.4.2 Priority areas for Saba

Coralita is gradually growing higher up onto Mt. Scenery, where it can do real damage to the native and unique nature. To prevent this from happening, the small specks of Coralita from the upper part of the Crispeen trail and next to Mr. Barnes' sheep pen should be cleared (see Figure 21). The amount of Coralita there is still small, so it might still be feasible to dig it up. Otherwise, it could be mowed every 2 months.

There are some areas where Coralita is threatening to exacerbate erosion by climbing into trees, such as the Flamboyant trees in in the Harbor gut and the Mahogany trees on Middle island, but also along the road in Gile's quarter and along the Dancing place trail (see Figure 22). Trees and shrubs have a much more elaborate root system than

Coralita, and therefore are preferable over Coralita. However, compared to nothing, Coralita at least hampers heavy rains from washing away the top soil. Coralita should thus be prevented from spreading to cliffs that currently have native vegetation, such as Sea grape. This is a very good erosion preventing and native species, which happens to produces grapes that birds and people alike can enjoy. Therefore, Sea grape should be planted above and on cliffs, to prevent erosion.

At the outskirts of current Coralita presence, containment and monitoring is called for. For example the presence above Dinda's supermarket (Hell's gate), along the mountain road, along the Well's Bay road and at Mary's point trail head (see Figure 23). From these locations, Coralita can easily creep up into valuable nature areas. Therefore, the borders of the spots should be mowed frequently, and further spreading checked for.

Regular check-ups and clearance should be done for all the trails. After all, early removal is easiest and cheapest. To that end, Coralita should be part of trail management.

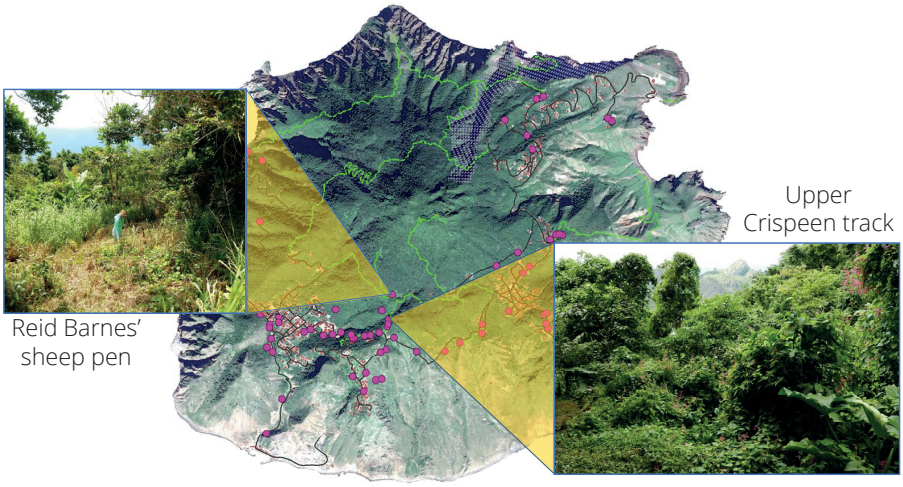


Figure 21. Recommended immediate removal areas on Saba. The pink dots are where Elizabeth Haber has found Coralita, between 2015 and 2018.

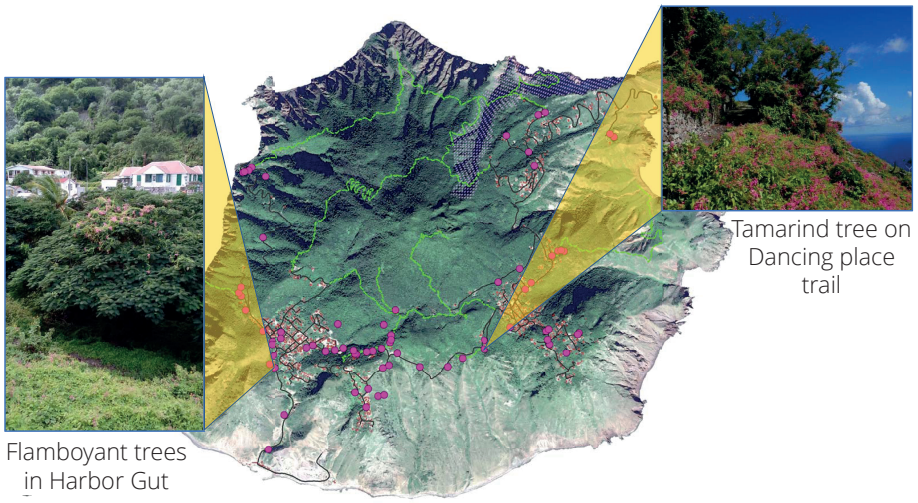


Figure 22. Erosion risk areas on Saba. The pink dots are where Elizabeth Haber has found Coralita, between 2015 and 2018.

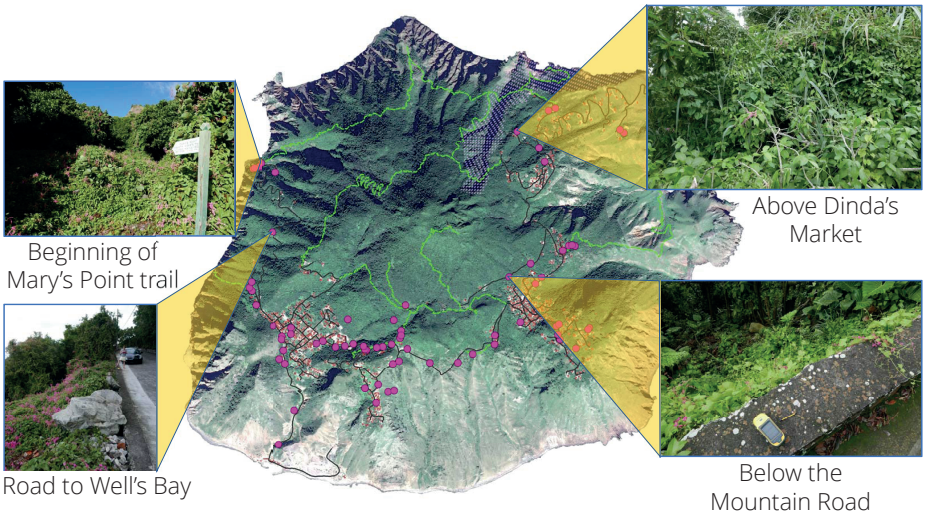


Figure 23. Recommended containment and monitoring areas on Saba. The pink dots are where Elizabeth Haber has found Coralita, between 2015 and 2018.

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Appendix

CHAPTER 2

Citation ID	Country/island	Organization	Date
1	Guadeloupe	Department of Environment, Infrastructure and Housing (DEAL)	7 Oct. 2015
2a	Guadeloupe	Regional Activity Centre for Specially Protected Areas and Wildlife (SPAW-RAC)	9 Oct. 2015
2b	Guadeloupe	Regional Activity Centre for Specially Protected Areas and Wildlife (SPAW-RAC)	9 Oct. 2015
3	Guadeloupe	Regional Council of Guadeloupe	13 Oct. 2015
4	Guadeloupe	National Park of Guadeloupe	12 Oct. 2015
5	St. Eustatius	Caribbean Netherlands Science Institute	19 Oct. 2015
6	St. Eustatius	St. Eustatius National Park (STENAPA)	21 Oct. 2015
7	St. Eustatius	Island government	23 Oct. 2015
8	St. Eustatius	Island government	23 Oct. 2015
9a	Anguilla	Anguilla National Trust	2 Nov. 2015
9b	Anguilla	Anguilla National Trust	2 Nov. 2015
9c	Anguilla	Anguilla National Trust	2 Nov. 2015
10	Anguilla	United Kingdom Overseas Territories Conservation Forum	3 Nov. 2015
11a	Anguilla	Department of Environment	5 Nov. 2015
11b	Anguilla	Department of Environment	5 Nov. 2015
12a	Anguilla	Department of Agriculture	6 Nov. 2015
12b	Anguilla	Department of Agriculture	6 Nov. 2015
13	Bonaire	Dutch Caribbean Nature Alliance (DCNA)	9 Nov. 2015
14	Bonaire	Rijksdienst Caribisch Nederland	12 Nov. 2015
15	Netherlands	Ministry of Internal Affairs and Kingdom Relations	26 Dec. 2015
16	France	Ministry of Ecology, Sustainable Development and Energy	2 Feb. 2016

Table 24. Background on the interviewees. The citation IDs correspond to the numbers mentioned in chapter 2. A, b and c indicate multiple interviewees participating in one interview. To guarantee anonymity, we have left out the positions within the organizations.

Sub-variable	Indicators	Citation ID
Autonomous decision-making centers		
	Multiple autonomous decision-making entities actively devise and enforce rules, norms, and strategies	**1-3**, 5, 7, 8, 9, 11, 14, 15, 17, **16**
	Opinions are implemented in practice by the decision-making centers	**1-3**, 5, 7, 8, 9, 11, 14
	The entities have a general understanding of each other's jurisdiction or domain of authority	**1, 3, 4,** 8, 9, 13, 15, **16**
	The decision-making centers have shared or common goals	**1, 2,** 5, 7, 8, 10, 11, 13, 14, 15, **16**
Coherence		
Overarching system of rules	The system of rules complies with the decision-making centers' needs	**1-3,** 5, 7, 8, 9, 10, 11, 12, 13, 14, 15
	The decision-making centers actively coordinate with one another and exchange knowledge	**1-4,** 7, 8, 9, 10, 13, 15, **16**
Stability	Frequency of changes to, duration of decision-making process regarding, constitutional configuration	**1, 3**, 6, 7, 8, 13, 15
	Contention surrounding the constitutional configuration	**2, 3,** 5, 6, 7, 8, 9, 13, 15, **16**
Tightness	Resource interdependencies: is the dependence one-way or mutual?	**1-4**, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15
	Geopolitical status island: legal status within EU and metropolis; citizenship; part of EU customs zone	**1, 2,** 7, 8, 11 13, 14, 15, **16**

Table 25. The variables and the interviews in which they were mentioned. The citation IDs correspond to the numbers mentioned in chapter 2 and in Table 24. Bold numbers indicate interviewees for the French case, underlined numbers are interviewees for the British case, and normal font are interviewees for the Dutch case

CHAPTER 3

Saban perspectives on value of nature

Ranks per factor

Future-oriented nature conservation

No.	Statement	Rank
22	Pressure Saba: medicine	-5
34	Pressure Saba: spiritual and religious	-5
35	Coralita Saba: spiritual and religious	-4
38	Pressure Saba: clean air, water and soil	-4
46	Pressure Saba: drinking water and renewable energy	-4
21	Important Saba: medicine	-3
23	Coralita Saba: medicine	-3
26	Pressure Saba: recreation and unwinding	-3
36	Protect Saba: spiritual and religious	-3
9	Important Saba: variety of animals and plants	3
25	Important Saba: recreation and unwinding	3
41	Important Saba: tourism opportunities	3
44	Protect Saba: tourism opportunities	3
1	Important Saba: scenery, sounds and smells	4
13	Important Saba: future generations experiencin	4
16	Protect Saba: future generations experiencing	4
17	Important Saba: nature intrinsically	5
20	Protect Saba: nature intrinsically	5

Table 26. Ranks for factor 1. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
17	Important Saba: nature intrinsically	5	2.25*	0	0.06	3	1.23
20	Protect Saba: nature intrinsically	5	2.06*	-1	-0.30	2	0.82
13	Important Saba: future generations experiencing Saba	4	1.52*	2	0.63	1	0.41
16	Protect Saba: future generations experiencing Saba	4	1.29	1	0.57	-4	-1.41
25	Important Saba: recreation and unwinding	3	1.25*	-2	-0.69	-1	-0.57
3	Coralita Saba: scenery, sounds and smells	2	0.69	4	1.44	-1	-0.41
42	Pressure Saba: tourism opportunities	1	0.29	-1	-0.53	-4	-1.25
27	Coralita Saba: recreation and unwinding	0	0.07*	-3	-1.03	-3	-0.99
45	Important Saba: drinking water and renewable energy	0	0.05*	5	2.14	5	2.24
33	Important Saba: spiritual and religious	0	-0.19	-5	-1.82	2	0.53
7	Coralita Saba: agriculture and livestock	0	-0.23*	3	1.00	5	1.73
2	Pressure Saba: scenery, sounds and smells	-1	-0.27*	2	0.97	-5	-2.28
48	Protect Saba: drinking water and renewable energy	-1	-0.29*	3	1.16	3	1.39
5	Important Saba: agriculture and livestock	-2	-0.70*	4	1.42	4	1.54
39	Coralita Saba: clean air, water and soil	-2	-0.77*	3	1.23	1	0.21
36	Protect Saba: spiritual and religious	-3	-0.95	-5	-1.89	0	-0.29
21	Important Saba: medicine	-3	-1.22	-1	-0.49	1	0.44
34	Pressure Saba: spiritual and religious	-5	-2.16	-4	-1.44	-2	-0.77

Table 27. Distinguishing statements for factor 1. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at $P \leq 0.01$, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Modern utilitarian

No.	Statement	Rank
33	Important Saba: spiritual and religious	-5
36	Protect Saba: spiritual and religious	-5
22	Pressure Saba: medicine	-4
34	Pressure Saba: spiritual and religious	-4
35	Coralita Saba: spiritual and religious	-4
24	Protect Saba: medicine	-3
27	Coralita Saba: recreation and unwinding	-3
28	Protect Saba: recreation and unwinding	-3
30	Pressure Saba: science and learning	-3
6	Pressure Saba: agriculture and livestock	3
7	Coralita Saba: agriculture and livestock	3
39	Coralita Saba: clean air, water and soil	3
48	Protect Saba: drinking water and renewable energy	3

3	Coralita Saba: scenery, sounds and smells	4
5	Important Saba: agriculture and livestock	4
46	Pressure Saba: drinking water and renewable energy	4
1	Important Saba: scenery, sounds and smells	5
45	Important Saba: drinking water and renewable energy	5

Table 28. Ranks for factor 2. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
3	Coralita Saba: scenery, sounds and smells	2	0.69	4	1.44	-1	-0.41
46	Pressure Saba: drinking water and renewable energy	-4	-1.66	4	1.38*	-4	-1.17
39	Coralita Saba: clean air, water and soil	-2	-0.77	3	1.23*	1	0.21
6	Pressure Saba: agriculture and livestock	-2	-0.73	3	1.21*	-1	-0.55
7	Coralita Saba: agriculture and livestock	0	-0.23	3	1.00	5	1.73
2	Pressure Saba: scenery, sounds and smells	-1	-0.27	2	0.97*	-5	-2.28
16	Protect Saba: future generations experiencing Saba	4	1.29	1	0.57	-4	-1.41
17	Important Saba: nature intrinsically	5	2.25	0	0.06*	3	1.23
38	Pressure Saba: clean air, water and soil	-4	-1.32	0	-0.09	-3	-0.97
20	Protect Saba: nature intrinsically	5	2.06	-1	-0.30*	2	0.82
41	Important Saba: tourism opportunities	3	1.20	-1	-0.42*	3	1.33
21	Important Saba: medicine	-3	-1.22	-1	-0.49	1	0.44
42	Pressure Saba: tourism opportunities	1	0.29	-1	-0.53	-4	-1.25
44	Protect Saba: tourism opportunities	3	1.13	-2	-0.97*	2	0.88
28	Protect Saba: recreation and unwinding	2	0.73	-3	-1.11*	0	0.20
33	Important Saba: spiritual and religious	0	-0.19	-5	-1.82*	2	0.53
36	Protect Saba: spiritual and religious	-3	-0.95	-5	-1.89*	0	-0.29

Table 29. Distinguishing statements for factor 2. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at $P \leq 0.01$, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Optimistic agri-ruralism

No.	Statement	Rank
2	Pressure Saba: scenery, sounds and smells	-5
22	Pressure Saba: medicine	-5
16	Protect Saba: future generations experiencing	-4
42	Pressure Saba: tourism opportunities	-4
46	Pressure Saba: drinking water and renewable energy	-4
14	Pressure Saba: future generations experiencing	-3

26	Pressure Saba: recreation and unwinding	-3
27	Coralita Saba: recreation and unwinding	-3
38	Pressure Saba: clean air, water and soil	-3
17	Important Saba: nature intrinsically	3
40	Protect Saba: clean air, water and soil	3
41	Important Saba: tourism opportunities	3
48	Protect Saba: drinking water and renewable energy	3
5	Important Saba: agriculture and livestock	4
9	Important Saba: variety of animals and plants	4
11	Coralita Saba: variety of animals and plants	4
7	Coralita Saba: agriculture and livestock	5
45	Important Saba: drinking water and renewable energy	5

Table 30. Ranks for factor 3. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
7	Coralita Saba: agriculture and livestock	0	-0.23	3	1.00	5	1.73
11	Coralita Saba: variety of animals and plants	2	0.60	1	0.56	4	1.56*
17	Important Saba: nature intrinsically	5	2.25	0	0.06	3	1.23*
40	Protect Saba: clean air, water and soil	1	0.24	0	0.13	3	1.04
20	Protect Saba: nature intrinsically	5	2.06	-1	-0.30	2	0.82*
1	Important Saba: scenery, sounds and smells	4	1.39	5	1.65	2	0.56*
33	Important Saba: spiritual and religious	0	-0.19	-5	-1.82	2	0.53
21	Important Saba: medicine	-3	-1.22	-1	-0.49	1	0.44*
39	Coralita Saba: clean air, water and soil	-2	-0.77	3	1.23	1	0.21*
35	Coralita Saba: spiritual and religious	-4	-1.35	-4	-1.77	0	-0.00*
23	Coralita Saba: medicine	-3	-0.98	-2	-0.83	0	-0.03
24	Protect Saba: medicine	-2	-0.77	-3	-1.08	0	-0.06
36	Protect Saba: spiritual and religious	-3	-0.95	-5	-1.89	0	-0.29
32	Protect Saba: science and learning	1	0.48	2	0.82	-1	-0.35*
3	Coralita Saba: scenery, sounds and smells	2	0.69	4	1.44	-1	-0.41*
19	Coralita Saba: nature intrinsically	1	0.44	0	0.15	-2	-0.83*
14	Pressure Saba: future generations experiencing Saba	-1	-0.32	1	0.30	-3	-0.95
42	Pressure Saba: tourism opportunities	1	0.29	-1	-0.53	-4	-1.25
16	Protect Saba: future generations experiencing Saba	4	1.29	1	0.57	-4	-1.41*
2	Pressure Saba: scenery, sounds and smells	-1	-0.27	2	0.97	-5	-2.28*

Table 31. Distinguishing statements for factor 3. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at $P \leq 0.01$, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Consensus statements Saba

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
4*	Protect Saba: scenery, sounds and smells	2	0.86	1	0.37	1	0.30
8	Protect Saba: agriculture and livestock	-1	-0.52	0	0.06	0	0.17
9*	Important Saba: variety of animals and plants	3	1.16	2	0.97	4	1.41
10*	Pressure Saba: variety of animals and plants	0	-0.14	-1	-0.36	-1	-0.55
12	Protect Saba: variety of animals and plants	2	0.58	0	-0.11	1	0.48
15*	Coralita Saba: future generations experiencing Saba	1	0.27	1	0.47	1	0.42
22*	Pressure Saba: medicine	-5	-1.95	-4	-1.46	-5	-1.70
26*	Pressure Saba: recreation and unwinding	-3	-0.95	-2	-0.97	-3	-0.97
29	Important Saba: science and learning	1	0.45	2	0.71	0	-0.05
30*	Pressure Saba: science and learning	-2	-0.73	-3	-1.07	-2	-0.93
31	Coralita Saba: science and learning	-1	-0.30	-1	-0.51	-2	-0.92
37	Important Saba: clean air, water and soil	0	0.16	1	0.57	2	0.81
43*	Coralita Saba: tourism opportunities	0	-0.07	0	-0.19	0	-0.21
47*	Coralita Saba: drinking water and renewable energy	-1	-0.61	-2	-0.55	-1	-0.60

Table 32. Consensus Statements for Saba. Those that do not distinguish between any pair of factors. All listed statements are son-significant at p>.01, and those flagged with an * are also non-significant at p>.05.

Statian perspectives on value of nature

Ranks per factor

Nature conservation for tourism

No.	Statement	Rank
22	Pressure Statia: medicine	-5
30	Pressure Statia: science and learning	-5
33	Important Statia: spiritual and religious	-4
34	Pressure Statia: spiritual and religious	-4
35	Coralita Statia: spiritual and religious	-4
6	Pressure Statia: agriculture and livestock	-3
26	Pressure Statia: recreation and unwinding	-3
36	Protect Statia: spiritual and religious	-3
46	Pressure Statia: drinking water and renewable energy	-3
9	Important Statia: variety of animals and plants	3
17	Important Statia: nature intrinsically	3

39	Coralita Statia: clean air, water and soil	3
44	Protect Statia: tourism opportunities	3
11	Coralita Statia: variety of animals and plants	4
12	Protect Statia: variety of animals and plants	4
18	Pressure Statia: nature intrinsically	4
20	Protect Statia: nature intrinsically	5
41	Important Statia: tourism opportunities	5

Table 33. Ranks for factor 1. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
20	Protect Statia: nature intrinsically	5	1.83*	0	0.15	1	0.72
41	Important Statia: tourism opportunities	5	1.56	-4	-1.39	2	0.75
11	Coralita Statia: variety of animals and plants	4	1.55	3	0.65	-1	-0.29
12	Protect Statia: variety of animals and plants	4	1.54	3	0.77	0	0.03
18	Pressure Statia: nature intrinsically	4	1.40*	-5	-1.39	0	0.03
9	Important Statia: variety of animals and plants	3	1.29	2	0.50	1	0.54
39	Coralita Statia: clean air, water and soil	3	1.00	0	0.25	-1	-0.23
44	Protect Statia: tourism opportunities	3	1.00*	-1	-0.51	-1	-0.44
10	Pressure Statia: variety of animals and plants	2	0.98*	-1	-0.51	-2	-0.85
47	Coralita Statia: drinking water and renewable ene	2	0.90*	-3	-1.15	-1	-0.65
19	Coralita Statia: nature intrinsically	2	0.87*	-2	-0.62	-1	-0.21
13	Important Statia: future generations experiencing	1	0.51*	-2	-0.63	4	1.68
45	Important Statia: drinking water and renewable en	1	0.29*	-2	-0.75	4	1.36
37	Important Statia: clean air, water and soil	0	0.12*	4	2.03	5	1.90
24	Protect Statia: medicine	-1	-0.15	2	0.61	-3	-1.01
42	Pressure Statia: tourism opportunities	-1	-0.18	-3	-1.14	-2	-0.96
29	Important Statia: science and learning	-1	-0.33	5	2.27	1	0.45
5	Important Statia: agriculture and livestock	-2	-0.82*	1	0.38	4	1.47
38	Pressure Statia: clean air, water and soil	-2	-0.87	4	1.27	0	-0.10
33	Important Statia: spiritual and religious	-4	-1.39*	-1	-0.39	3	1.04
30	Pressure Statia: science and learning	-5	-2.00*	3	1.15	-3	-1.16

Table 34. Distinguishing statements for factor 1. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at $P \leq 0.01$, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Utilitarian scientists

No.	Statement	Rank
18	Pressure Statia: nature intrinsically	-5
36	Protect Statia: spiritual and religious	-5
35	Coralita Statia: spiritual and religious	-4
41	Important Statia: tourism opportunities	-4
43	Coralita Statia: tourism opportunities	-4
21	Important Statia: medicine	-3
34	Pressure Statia: spiritual and religious	-3
42	Pressure Statia: tourism opportunities	-3
47	Coralita Statia: drinking water and renewable energy	-3
1	Important Statia: scenery, sounds and smells	3
11	Coralita Statia: variety of animals and plants	3
12	Protect Statia: variety of animals and plants	3
30	Pressure Statia: science and learning	3
17	Important Statia: nature intrinsically	4
37	Important Statia: clean air, water and soil	4
38	Pressure Statia: clean air, water and soil	4
29	Important Statia: science and learning	5
32	Protect Statia: science and learning	5

Table 35. Ranks for factor 2. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
32	Protect Statia: science and learning	0	0.09	5	2.40*	0 -	0.10
29	Important Statia: science and learning	-1	-0.33	5	2.27*	1	0.45
17	Important Statia: nature intrinsically	3	1.15	4	1.91	2	0.76
38	Pressure Statia: clean air, water and soil	-2	-0.87	4	1.27*	0	-0.10
30	Pressure Statia: science and learning	-5	-2.00	3	1.15*	-3	-1.16
12	Protect Statia: variety of animals and plants	4	1.54	3	0.77	0	0.03
11	Coralita Statia: variety of animals and plants	4	1.55	3	0.65	-1	-0.29
24	Protect Statia: medicine	-1	-0.15	2	0.61	-3	-1.01
31	Coralita Statia: science and learning	-2	-0.88	1	0.39*	-3	-1.33
5	Important Statia: agriculture and livestock	-2	-0.82	1	0.38*	4	1.47
22	Pressure Statia: medicine	-5	-1.55	0	0.23*	-5	-1.77
26	Pressure Statia: recreation and unwinding	-3	-1.32	0	-0.13*	-4	-1.50
15	Coralita Statia: future generations experiencing Statia	2	0.90	0	-0.36*	2	0.96

33	Important Statia: spiritual and religious	-4	-1.39	-1	-0.39*	3	1.04
13	Important Statia: future generations experiencing Statia	1	0.51	-2	-0.63*	4	1.68
45	Important Statia: drinking water and renewable energy	1	0.29	-2	-0.75*	4	1.36
43	Coralita Statia: tourism opportunities	0	0.22	-4	-1.27	-1	-0.42
41	Important Statia: tourism opportunities	5	1.56	-4	-1.39*	2	0.75
18	Pressure Statia: nature intrinsically	4	1.40	-5	-1.39*	0	0.03

Table 36. Distinguishing statements for factor 2. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at P ≤ 0.01, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Bright future for community sustainability

No.	Statement	Rank
22	Pressure Statia: medicine	-5
27	Coralita Statia: recreation and unwinding	-5
26	Pressure Statia: recreation and unwinding	-4
35	Coralita Statia: spiritual and religious	-4
46	Pressure Statia: drinking water and renewable energy	-4
2	Pressure Statia: scenery, sounds and smells	-3
24	Protect Statia: medicine	-3
30	Pressure Statia: science and learning	-3
31	Coralita Statia: science and learning	-3
8	Protect Statia: agriculture and livestock	3
16	Protect Statia: future generations experiencing Statia	3
33	Important Statia: spiritual and religious	3
36	Protect Statia: spiritual and religious	3
5	Important Statia: agriculture and livestock	4
13	Important Statia: future generations experiencing Statia	4
45	Important Statia: drinking water and renewable energy	4
37	Important Statia: clean air, water and soil	5
48	Protect Statia: drinking water and renewable energy	5

Table 37. Ranks for factor 3. This is a part of the table of the idealized Q sort. A rank of -5 means this statement was placed on the Least like how I think-end, while +5 was placed on the Most like how I think-end of the continuum.

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
48	Protect Statia: drinking water and renewable energy	0	0.26	0	0.12	5	1.68*
13	Important Statia: future generations experiencing Statia	1	0.51	-2	-0.63	4	1.68*

5	Important Statia: agriculture and livestock	-2	-0.82	1	0.38	4	1.47*
45	Important Statia: drinking water and renewable energy	1	0.29	-2	-0.75	4	1.36*
16	Protect Statia: future generations experiencing Statia	1	0.32	1	0.38	3	1.25
36	Protect Statia: spiritual and religious	-3	-1.23	-5	-1.77	3	1.19*
8	Protect Statia: agriculture and livestock	-2	-1.03	-1	-0.52	3	1.16*
33	Important Statia: spiritual and religious	-4	-1.39	-1	-0.39	3	1.04*
21	Important Statia: medicine	-2	-0.94	-3	-1.02	2	0.89*
41	Important Statia: tourism opportunities	5	1.56	-4	-1.39	2	0.75
29	Important Statia: science and learning	-1	-0.33	5	2.27	1	0.45
12	Protect Statia: variety of animals and plants	4	1.54	3	0.77	0	0.03
18	Pressure Statia: nature intrinsically	4	1.40	-5	-1.39	0	0.03*
6	Pressure Statia: agriculture and livestock	-3	-1.27	-2	-1.02	0	0.00*
1	Important Statia: scenery, sounds and smells	2	0.66	3	1.14	0	-0.04
38	Pressure Statia: clean air, water and soil	-2	-0.87	4	1.27	0	-0.10
11	Coralita Statia: variety of animals and plants	4	1.55	3	0.65	-1	-0.29
28	Protect Statia: recreation and unwinding	1	0.35	1	0.39	-2	-0.96*
24	Protect Statia: medicine	-1	-0.15	2	0.61	-3	-1.01*
30	Pressure Statia: science and learning	-5	-2.00	3	1.15	-3	-1.16*
2	Pressure Statia: scenery, sounds and smells	0	0.15	1	0.36	-3	-1.33*
27	Coralita Statia: recreation and unwinding	0	-0.05	0	-0.25	-5	-1.73*

Table 38. Distinguishing statements for factor 3. "PQMethod generates a set of distinguishing statements for each factor based on the statistically significant difference between each statement's normalized z-scores across all factors at P ≤ 0.01, two-tailed, critical value = 0.449." (Cheng and Mattor 2005, 551). For comparison, the scores of those statements on the other factors are listed as well.

Consensus statements Statia

		Factor 1		Factor 2		Factor 3	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
34	Pressure Statia: spiritual and religious	-4	-1.46	-3	-1.14	-2	-0.84
35	Coralita Statia: spiritual and religious	-4	-1.46	-4	-1.28	-4	-1.33
14	Pressure Statia: future generations experiencing Statia	-1	-0.71	-1	-0.37	-2	-0.86
23	Coralita Statia: medicine	-1	-0.73	-2	-1.02	0	-0.10
3	Coralita Statia: scenery, sounds and smells	0	-0.09	2	0.65	0	0.05
40	Protect Statia: clean air, water and soil	0	0.26	2	0.63	2	0.74
4	Protect Statia: scenery, sounds and smells	1	0.28	1	0.38	1	0.41
25	Important Statia: recreation and unwinding	1	0.66	2	0.50	1	0.37
9	Important Statia: variety of animals and plants	3	1.29	2	0.50	1	0.54

Table 39. Consensus Statements for Statia. Those that do not distinguish between any pair of factors. All listed statements are son-significant at p>.01.

CHAPTER 4

Evaluation criteria addressed in interviews or focus group

Criteria for adjusted PAR	Operationalization
Process criteria	
Envisioning of improvements to practices and sticking points	The participants were able to jointly envision changes to practices and sticking points that would improve their livelihoods and positively affect the latent problem.
Representativeness of participants	Participants feel the breadth of local views was represented in the team.
Full co-production	Participants were involved in the entire PAR-L trajectory.
Facilitation fosters inclusiveness and power balance	Participants feel their views were equally important and represented.
Collective decision-making through deliberation	Participants feel decisions were made by them all together.
Knowledge and views are accessible to and known by all participants	Participants feel they were aware of everyone's views and knowledge, and of decisions made.
Adaptability through iterative research cycles	The project could be adapted while ongoing, or new cycles started.
Outcome criteria	
Cost-effectiveness of the project	The ratio of investments required from participants to the improvements they experienced.
Social learning and knowledge co-produced	Participants learned from each other and produced knowledge together.
Legitimacy of the project	Participants feel the project was legitimate.
Improvements to livelihoods	Participants think the project has resulted in improvements to their day-to-day lives.
Improvements to latent problem	The authors think the project positively affected the latent environmental problem.
Impact criteria	
Upscale potential of the project	Are there any possibilities and plans for upscaling the project?
Understanding of the inertia	Were we able to identify the relevant practices and sticking points resulting in community inertia?
Overcoming the inertia	Were we able to change anything about the community inertia?

Green = to be factually established by authors of this paper
Yellow = to be discussed with core team members during interviews
Blue = To be discussed both in interviews and focus group

Table 40. Criteria for evaluation of a PAR project and how they are evaluated

Survey regarding perceptions of Coralita

As can be seen in Figure 24, the core team members and the other respondents are roughly similar. There are relatively more non-permanent residents among the core team members, which tallies with the observation that it is hard to get local Sabans involved. This dynamic may explain why there are also fewer farmers among the core team members, since the duration of their stay on Saba may be too short to make farming efforts worthwhile.

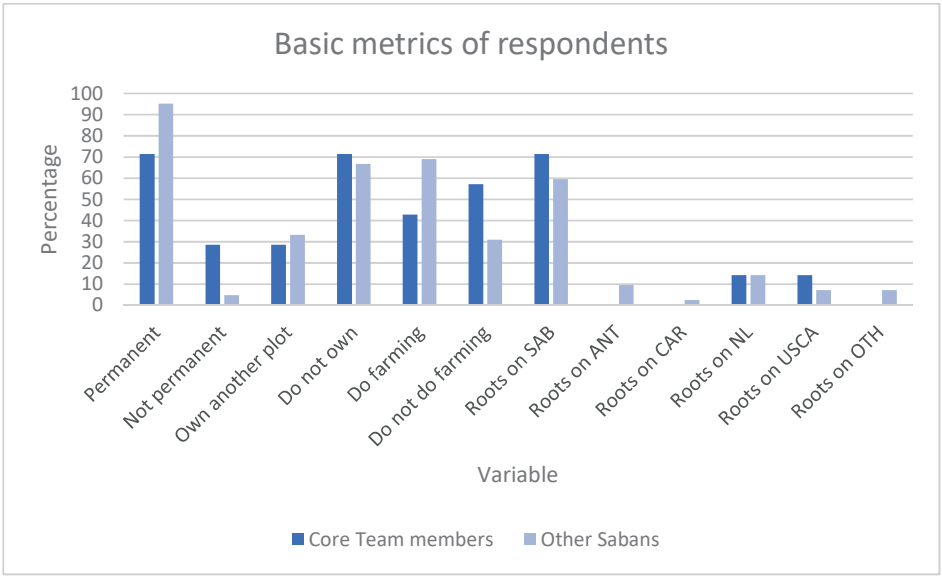

Figure 24. Comparison between core team members (n=7) and other Sabans (n=42) in terms of basic metrics. For explanation of variables, see Table 41.

Is your stay on Saba permanent?	Permanent: yes, it is permanent Not permanent: no, it is not permanent
Apart from your yard, do you own any land on Saba?	Own another plot: yes, I own another piece of land Do not own: no, I do not own another piece of land
Do you do any (backyard) farming?	Do farming: yes, I do some farming Do not do…: no, I do not do farming
Where do you feel your roots are?	Roots SAB: I feel my roots are on Saba Roots ANT: I feel my roots are on Statia, St. Maarten, Curaçao, Bonaire or Aruba Roots CAR: I feel my roots are somewhere else in the Caribbean Roots NL: I feel my roots are in the European Netherlands Roots USCA: I feel my roots are in the USA or Canada Roots OTH: I feel my roots are somewhere else

Table 41. The survey on Coralita's invincibility: labels and questions with answers

For the question on removal frequency (see Table 42), the answer options were: once a week, once every two weeks, once a month, once every three months, and less often or never. For the other questions, the answer options were: Agree (the number of people who chose "Highly agree" or "Agree"); Neutral (the number of people who chose "I don't know/not applicable") and Disagree (the number of people who chose "Disagree" or "Highly disagree"). Important to note is that the ex-post questionnaire was filled out by six of the seven core team members.

Label	Survey question
Removal is impossible	If you have Coralita on your land, it's impossible to remove.
Incentive is required	People need an incentive to clear Coralita from their land.
Saba incapable	Saba is incapable of dealing with Coralita.
Worthwhile	It is worthwhile putting effort into keeping your land Coralita-free.
Jointly capable	If we make a joint effort, Saba can deal with Coralita.
No good reason	I do not have a good reason to remove Coralita from my land.
Regular maintenance	With regular maintenance Coralita is manageable.
Remarks	If you would like to explain any of your answers above, or have a remark regarding the statements, please type that here.
Good reason for removal	A good reason to remove Coralita from my land would be:
Removal frequency	When given a good reason, how often would you be willing to remove Coralita from your land?

Table 42. The survey of Coralita's invincibility: labels and questions.

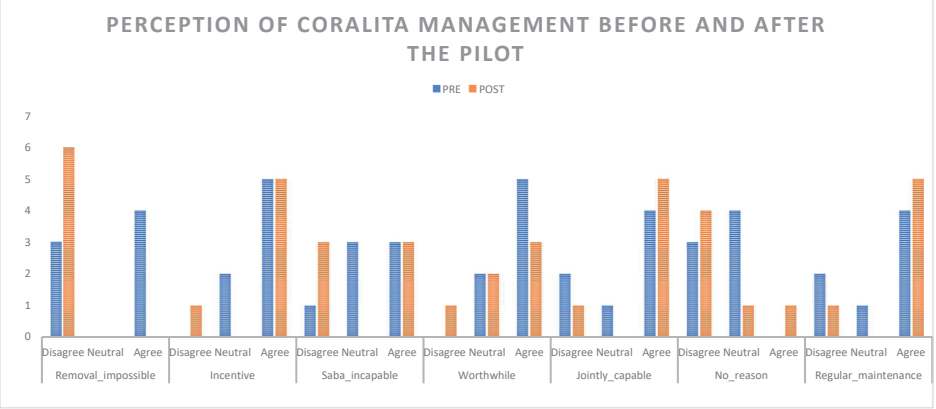

Figure 25. Perceptions of Coralita's invincibility among the core team members, before and after the pilot. The labels are explained in Table 42.

Full description of the project regarding Coralita on Saba

Step 1. Researchers approach the community about the latent problem

The issue of Coralita in Saba is discussed in detail in section 4.3. The authors had been working on this topic on Saba since 2015, and through two earlier fieldwork campaigns the first author had been in contact with the community about the invasive alien vine, which is widely considered a nuisance (Vaas et al. 2017, Vaas et al. 2019). She started this project with a new fieldwork campaign, announcing the plan to co-create a project with Sabans on anything related to Coralita.

Step 2. Exploring the community's practices

We conducted ten exploratory interviews with potential stakeholders on Coralita management, aiming to find practices affecting Coralita presence and to gauge interest in setting up a Coralita-related project. The interviewees were drawn from local government (3), nature conservation organisations (2), farmers and gardeners (2), the dean of the high school and two "normal" citizens. Two of them offered their Coralita-infested land to be used as part of the project. From these interviews, we obtained a first sense of practices affecting Coralita: for details, see section 4.3.2.

At the end of 2016 we used PPGIS to identify Coralita "hotspots", i.e., areas where people are fiercely opposed to its actual or hypothetical presence. The 50 layers were overlain: the brighter the pink, the more people selected that area. The maximum number of people selecting the same area was 17 (see Figure 8). The top of Mt. Scenery, the peak at the center of the island, stands out, as do the four separate clusters of roads that are the villages. St. John's is a village with very dense Coralita cover, so we chose it as our area for setting up a project. Figure 26 shows a close-up of the village, with the yellow indicating Coralita presence. The two pink areas are the properties offered by two locals for the project.

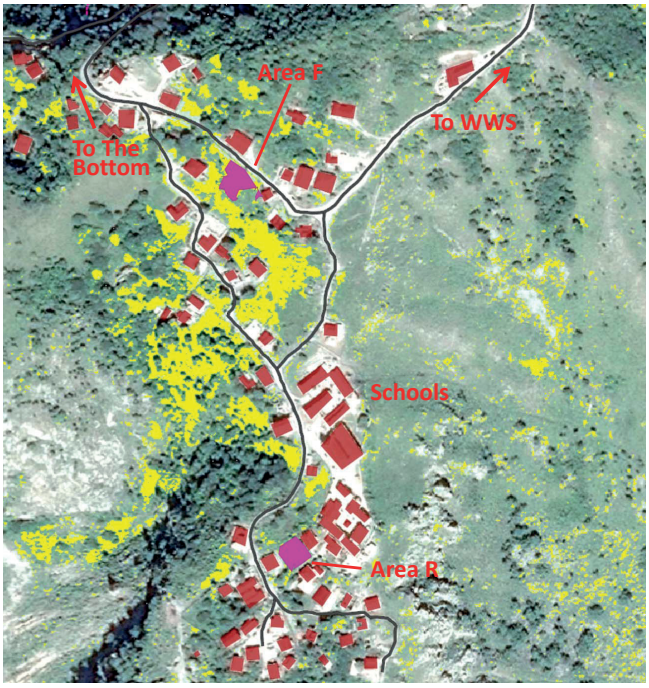

Figure 26. Map of St. John's, with project areas indicated by authors in pink (Google Earth 2016). Coralita in yellow, according to a tentative classification by Haber (unpublished material). Red shows the roofs of buildings such as houses and schools. The direction of the other villages of The Bottom and Windwardside (WWS) are indicated.

Step 3. Envisioning improvements to practices and sticking points

We organized a brainstorming evening to discuss the Coralita-related practices, elicit improvements the community would like to see, and put together a core team of participants. For this we approached the Saban Lion's club, and they discussed the matter during a members' meeting. One member, who offered the use of his land, committed to our project. Simultaneously, we organized an evening open to all on 1 February 2018, advertising it via posters, radio, Facebook and personal invitations. It took place in the high school's cafeteria, which we deemed a comfortable and accessible venue for everyone. Pizzas were provided, since the event took place during dinner time, and the first author facilitated the evening. A total of 16 people showed up, seven of whom volunteered for the project's core team (as listed in Table 43). Discussion during the evening centered around the practice of land lying fallow, and of the decline of agriculture. Ideas for more attractive uses for Coralita-infested land were listed and voted for, as shown in Figure 27. Planting fruit trees was seen by everyone as an improvement to the land-use, as counteracting declining agriculture practices and as benefiting their livelihoods. It was therefore decided to implement a pilot project in which Coralita-infested land is converted into a fruit orchard. For this pilot, the core team of seven participants decided to use a plot of land in St. John's made available by one of them.

Name	Nationality	Position/role
Franklin Wilson	Saban	Acting governor; offered property for project
Rolando Wilson	Saban	Commissioner with responsibility for, amongst others, nature & agriculture; offered property for project
Christabelle Hassell	Saban	Head of the public works' gardening group
Raymond Gomez	Saban	Retiree, inhabitant of St. John's, farmer
Vanessa Wilson	Saban	Daughter of Franklin Wilson
Jens Odinga	Dutch	Nature education professional, former Saba Conservation Foundation employee
Ryan Espersen	Canadian	Archaeologist, director of Saba Heritage Center

Table 43. Members of the project's core team, who gave permission to be mentioned by name.

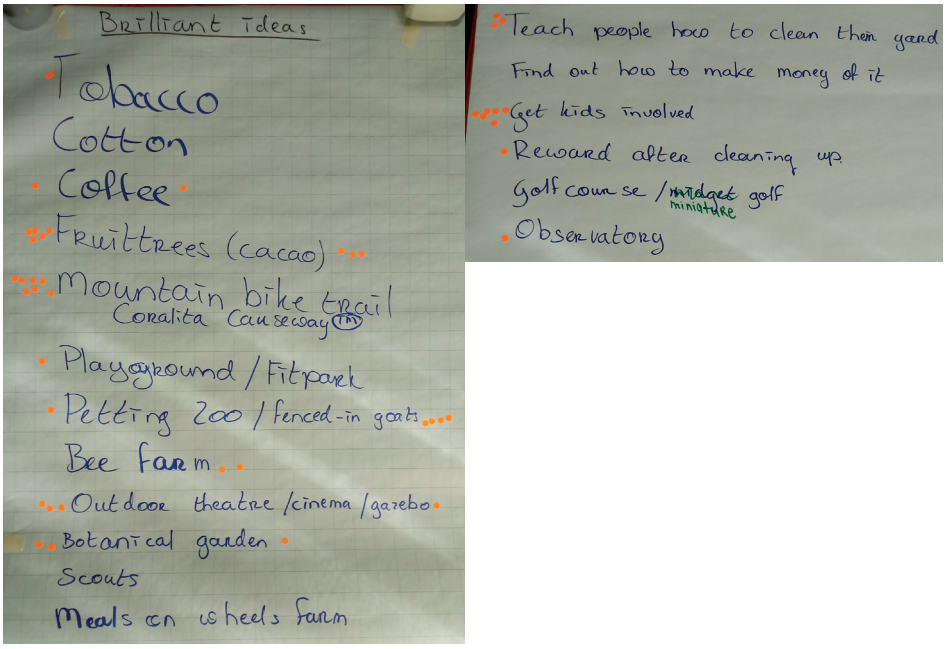

Figure 27. Ideas resulting from the brainstorming on 1 February 2018; orange dots indicate votes from participants.

Step 4. Designing a project

Given the project's aim, the most feasible and appropriate option proposed during the brainstorming meeting appeared to be the planting of fruit and vegetables for consumption. Keeping in mind that we were looking for alternative uses appropriate for all Sabans, all other ideas such as pet zoos or an outdoor theatre had to be rejected. We therefore approached several local farmers to ask for their recommendations on what to plant in the St. John's area. We asked them to take into account the climate, soil type and the plants attractive for humans. This resulted in the following recommendations:

- Lloyd Simmons: grafted mango trees.
- Mopsy Every: citrus trees.
- Tom van 't Hof: cashew, grafted mango, maybe citrus (very drought-resistant, but their root system is delicate), fiddlewood, soursop (*Annona muricata*), seagrape, kinep. Coffee needs shade and water, which are scarce of in St. John's.
- Randall Johnson: all the foregoing, and maybe dump tree (Pomme-surette/dunk tree, *Ziziphus mauritiana)*.

Together with the head of the local Department of Agriculture, we visited the area and made a planting design per plot. It was sent to the core team and their input was requested. They approved unanimously and made suggestions regarding where to get seeds or slips.

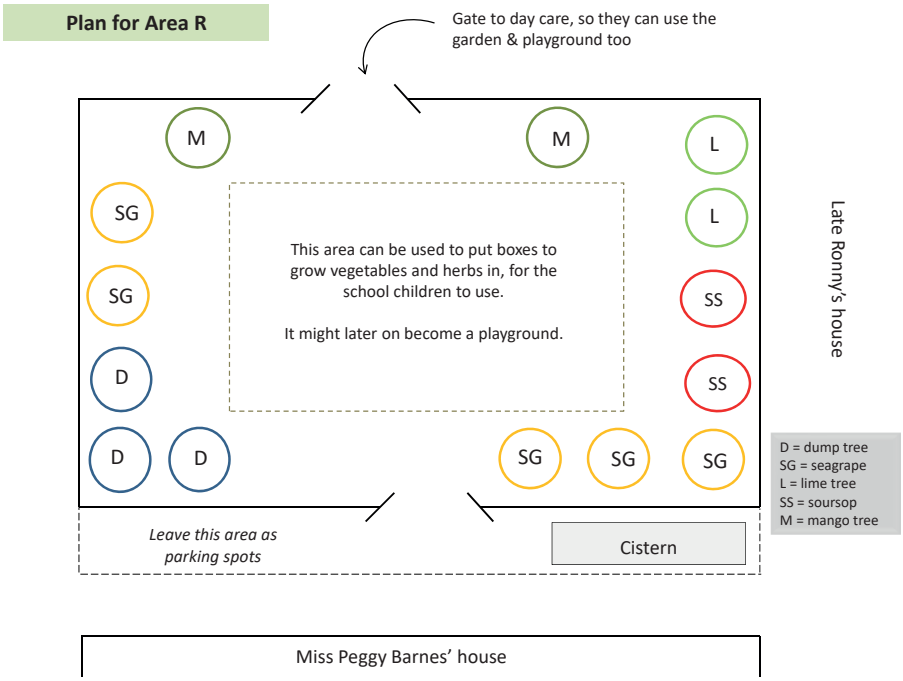

Figure 28. Planting design prepared for area R, 12 February 2018

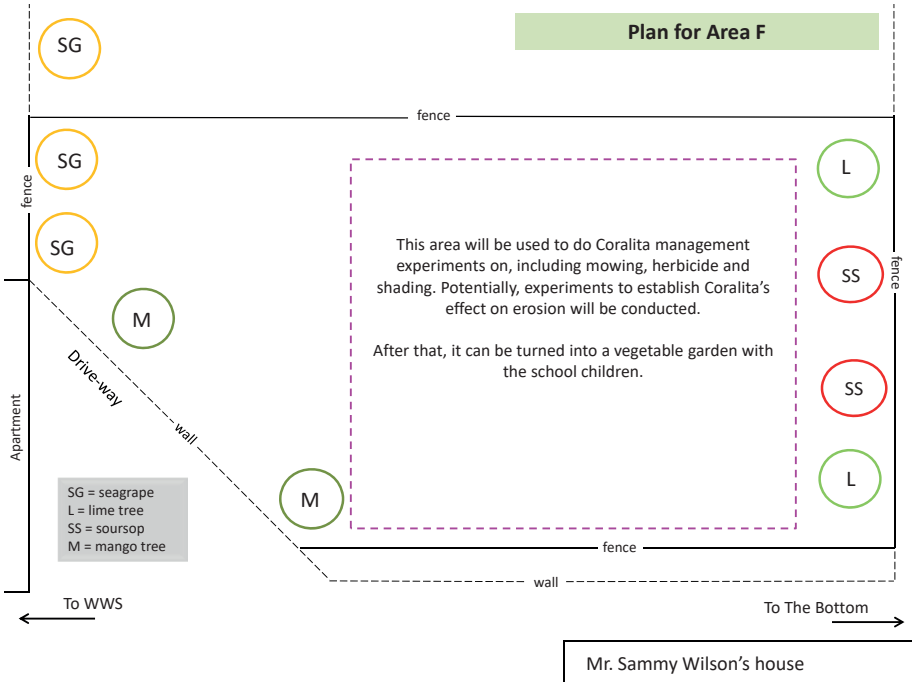

Figure 29. Planting design prepared for area F, 12 February 2018

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Step 5. Project implementation and documenting what happens

Plants

Given the absence of a nursery or garden center on the island, we were limited to seeds and seedlings made available by locals. The organoponic garden of the REACH foundation had five lemon trees available, which were ready to be planted. Additionally, we were given seeds for soursop and cotton, and people committed to growing kinep, indigo and bougainvillea. Ordering trees to be brought in would have taken four months, so was not feasible given the project planning.

Involvement of children

We had two meetings with the high school and one with the primary school, on involving their students in the project. This did not appear feasible within the project's duration, and they both referred to the after-school care organization "Child focus" and the children living in the proximity of the project. A Child focus group did indeed help remove Coralita from the property, as a preparation for the planting.

Planting and fencing

St. John's has many free-roaming goats, and neither of the two properties made available were fenced. A local contractor provided an estimate for the cost of fencing area F, which was 10000 USD. This figure was confirmed as realistic by several locals. The government indicated it would only subsidize fences for fulltime farmers, and not for a project like this. Moreover, area F did not have a water supply (see below). In consultation with the owner, we therefore decided to abandon the plans for area F and focus on area R. On 8 March 2018, the Department of Agriculture and one author planted five lemon trees on area R, near the left side of the plot. Plans to turn the area into a playground were materializing quicker than expected, and the government had indicated this planting design to be compatible with the playground. To protect against goats, the Department of Agriculture put a fence around each tree. The fences were reinforced in the first week of April 2018 by Randall Johnson, since the goats had been pushing against them. Towards the end of April 2018, one fence was pushed over and the tree half eaten. Raymond rescued the tree and reinforced the fence with some stones. In May the project team decided to delay any further planting until after the hurricane season and until the playground had been built.

Water

On Saba, people rely on rainwater for drinking, and occasionally order water from the desalinization plant. Area R has an old cistern, which still contained a little water and was refilled by the government free of cost. One member of the core team, Raymond Gomez, watered the trees every morning.

Coralita regrowth

Two weeks after planting, Coralita had already appeared next to the lemon trees. It was removed by the first author on 22 March 2018. After that, no-one attempted to remove any Coralita, except for any plants growing within the fence, which were removed by Raymond.

Expenses

The money invested was:

- 40 USD for the lemon trees
- 25 USD for pots and soil to grow seeds
- 12 USD for a bucket and rope to hoist water from the cistern
- 10 USD for garbage bags to put Coralita in
- 60 USD for rebars and chicken wire fencing (provided by the government)
- 60 USD for 1000 gallons of water (provided by the government)
- 5 hours to clear Coralita, but from a much larger area than needed for planting
- 1 hour potting the seeds that would be planted later on
- 2 hours planting the trees and putting up the fence
- 0.5 hours daily watering the trees
- 0.5 hours a week for weeding

Step 6. Dissemination and discussing of findings

In mid-June 2018 we started rounding off the project and disseminating the findings via email, Facebook and orally, hence reaching both the general public and interested parties who had registered for updates. We conducted a poll to gauge interest in a presentation and discussion, and in response to several interested people such an event was held on 31 May 2018. Seven Sabans attended. In addition, interviews were conducted with core team members, and a focus group meeting was held immediately before the public discussion event. Most of the questions posed to the focus group were different from those posed in the interviews, see Table 40, but a common question was whether the core team members found this approach suitable for upscaling across Saba and an appropriate alternative land-use.

Step 7. Reflection on the project

As mentioned under step 6, we conducted separate interviews and held a focus group meeting with the core team members. As for the success of the current project, the core team agreed that the trees were doing well but required a couple of resources that might prevent scaling up. The most important resource is willingness to invest time: one member was spending time on the five trees every day, but it was expected that most Sabans would not be willing to do so. In addition, the costs of fencing and water are

significant, and investments in more cisterns and stronger fences would be required. The restrictive costs of fencing can be seen by comparing Coralita presence in gardens with and without fences, as discussed in section 4.3.2 and depicted in Figure 30 below. As for the impact on Coralita, most of the core team members agreed it had been too small. One member found that at least the area at the base of each tree had been kept clean, and that when scaled up this could be a significant area. Another member found our project confirmed that people should start doing agriculture again, since that forces them to regularly curb Coralita. Overall, the members agreed that planting trees is indeed a suitable alternative land-use but would probably not have any real impact on Coralita as long as the constraints of time, water and fences are not overcome.

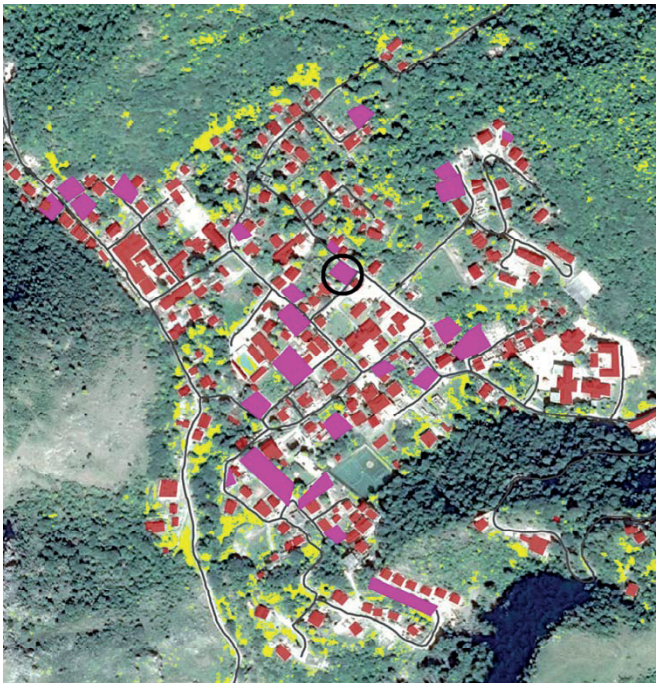
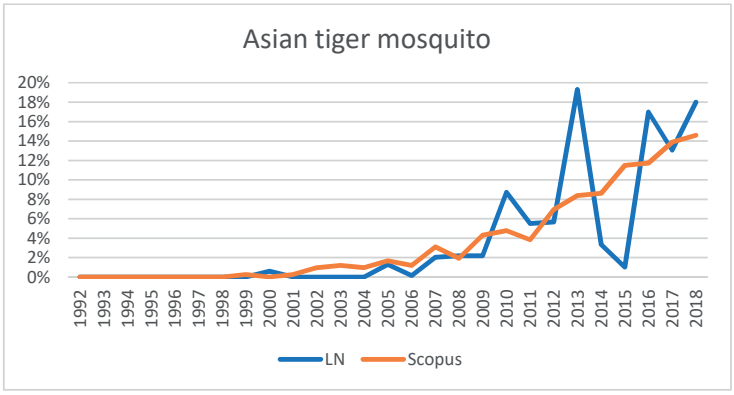
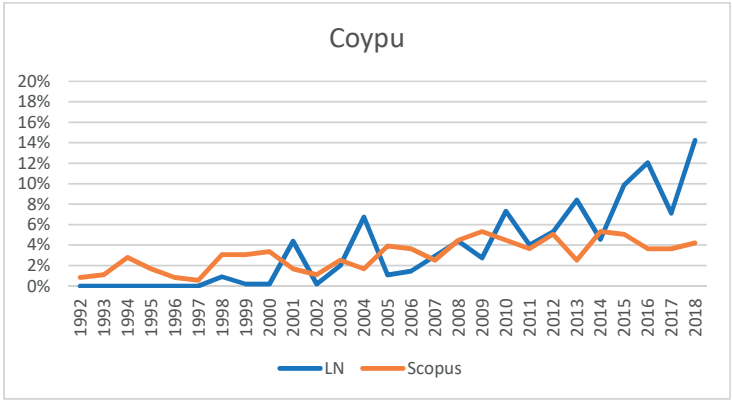


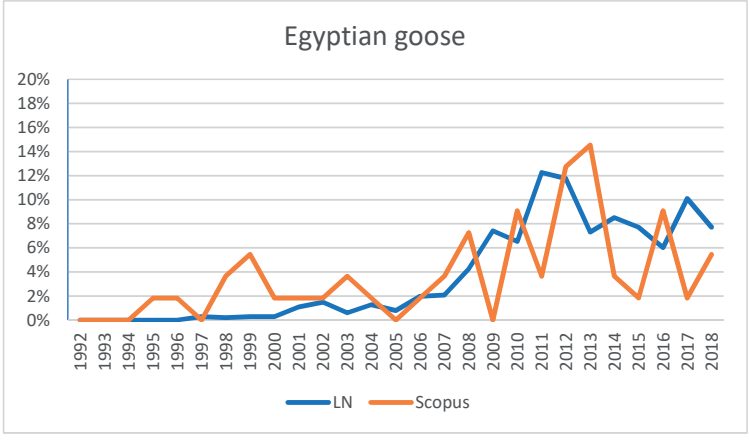
Figure 30. Map of fences and Coralita in The Bottom, Saba on a Google Earth image (Google Earth 2016). Fenced-in areas in pink. Coralita in yellow, according to a tentative classification by Haber (unpublished material). The black circle indicates the one property where Coralita was present in combination with an intact fence. This fence looked very new, so clearing might have been scheduled for later. Collected March 2018.

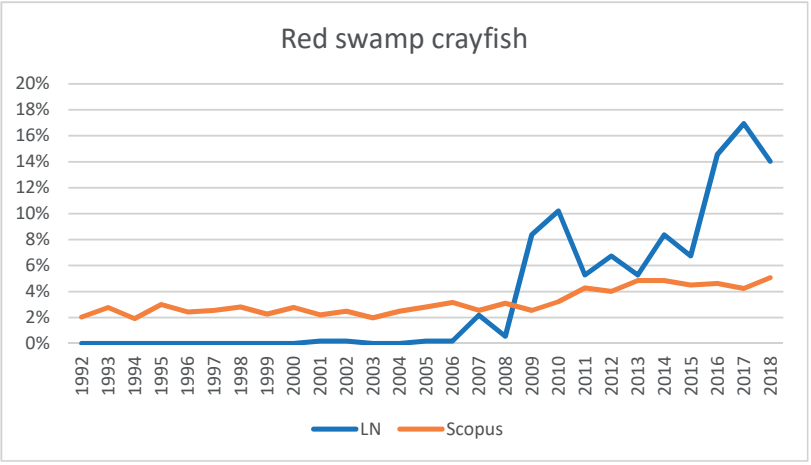
CHAPTER 5

Graphs of thirteen IAS








Red swamp crayfish
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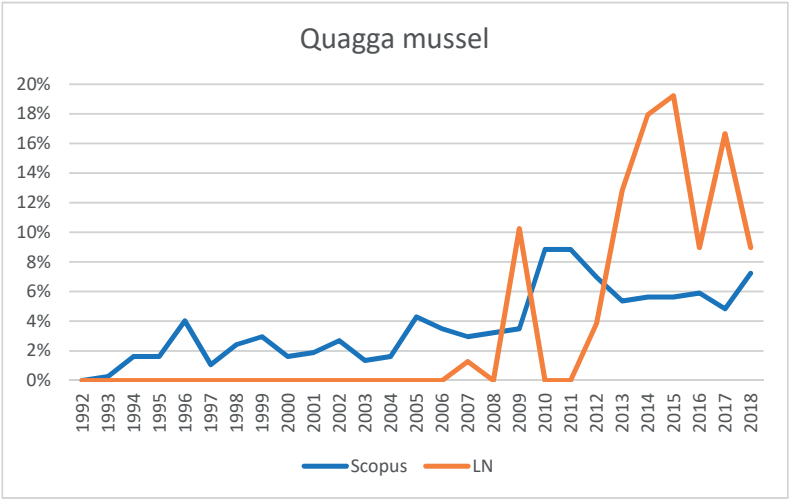
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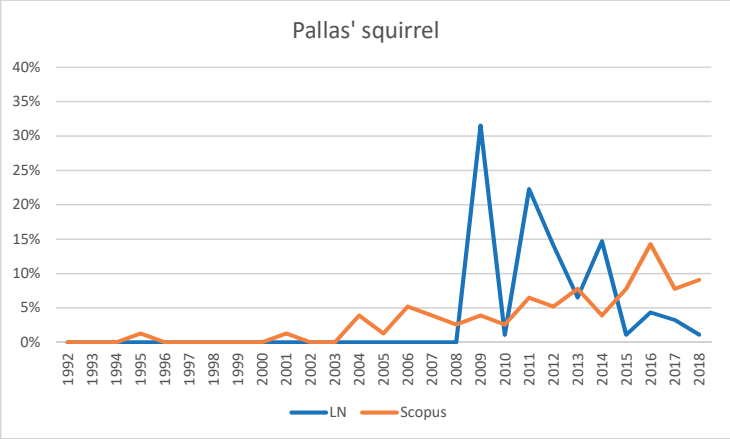
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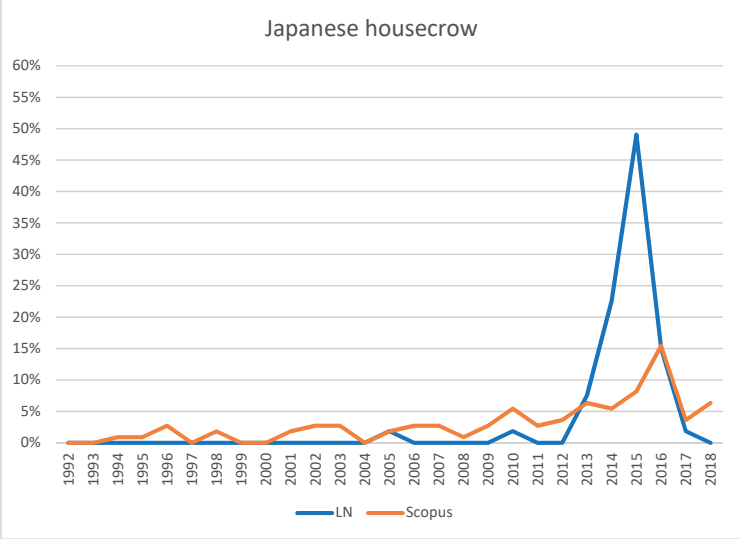
Japanese housecrow
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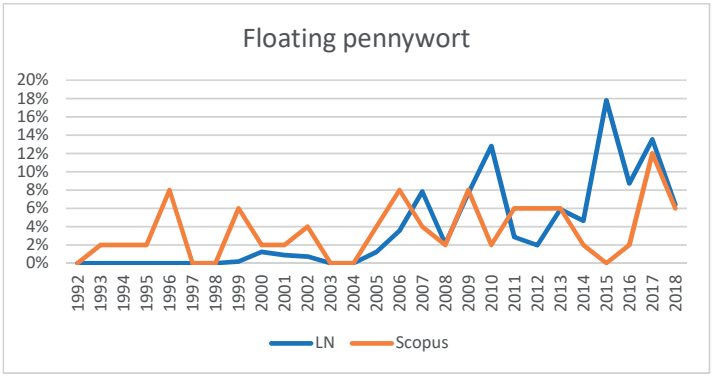
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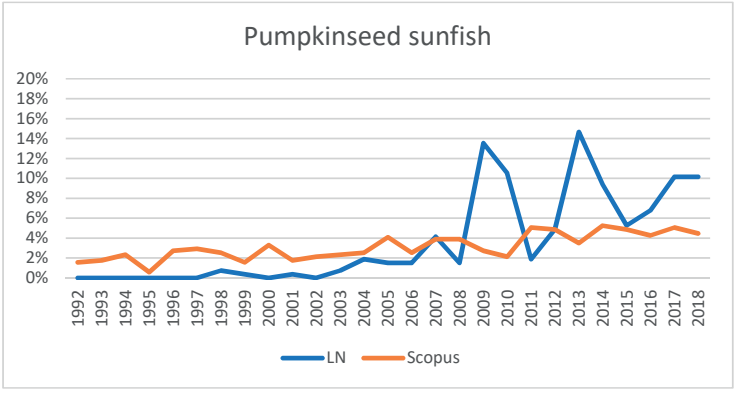
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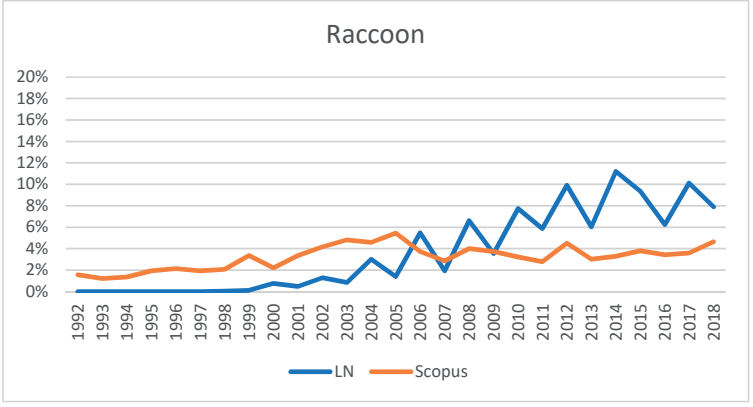
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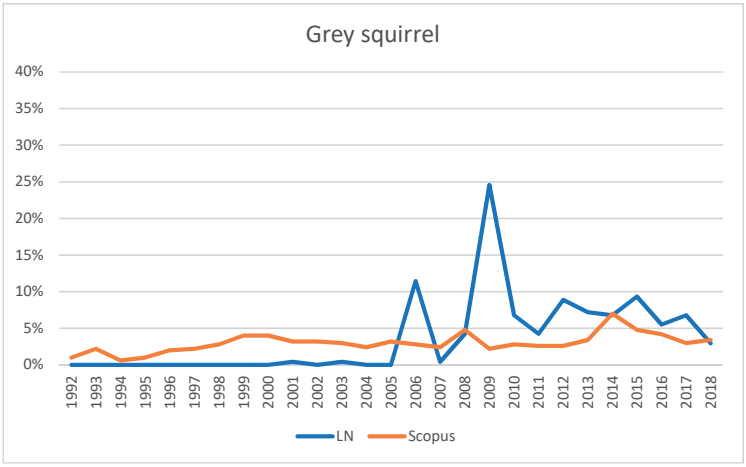
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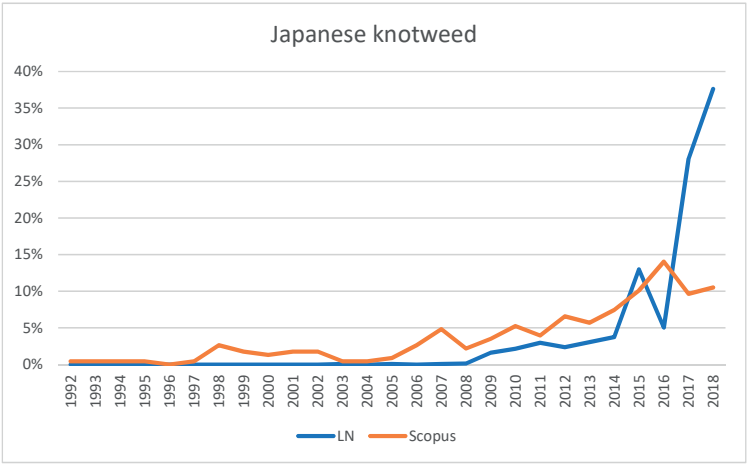
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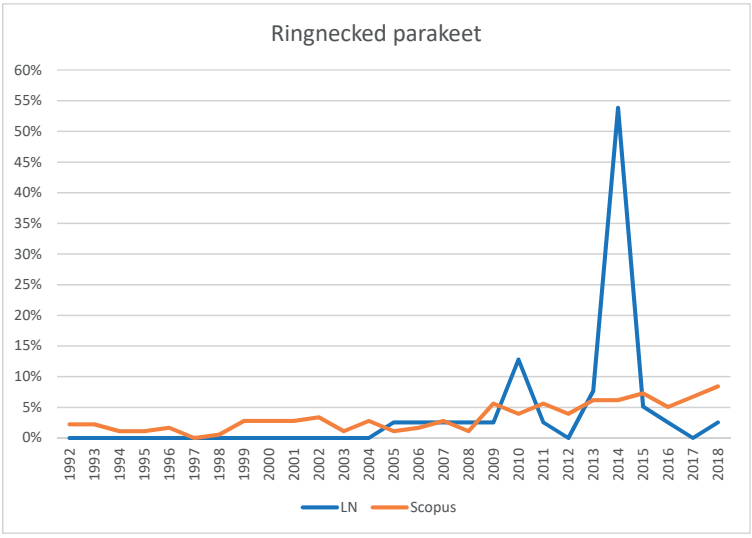

Figure 31. Publications in newspaper and governmental databases, distributed over time, for the 13 species focused on in chapter 5.

Taxonomic group	Common name	Common Dutch name	Latin name	Source
Mammal	Coypu/nutria rat	Beverrat	*Myocastor coypus*	Boomblad
Bird	Egyptian goose	Nijlgans	*Alopochen aegyptiacus*	Boomblad
Aquatic plant	Floating pennywort	Grote waternavel	*Hydrocotyle ranunculoides*	Boomblad
Mammal	Grey squirrel	Grijze eekhoorn	*Sciurus carolinensis*	Boomblad
Terrestrial plant	Japanese knotweed	Japanse duizendknoop	*Reynoutria japonica*	Boomblad
Mammal	Muskrat	Muskusrat	*Ondatra zibethicus*	Boomblad
Mammal	Pallas' squirrel	Pallas' eekhoorn	*Callosciurus erythraeus*	Boomblad
Invertebrate	Pumpkinseed sunfish	Zonnebaars	*Lepomis gibbosus*	Boomblad
Mammal	Raccoon	Wasbeer	*Procyon lotor*	Boomblad
Freshwater invertebrate	Red swamp crayfish	Rode Amerikaanse rivierkreeft	*Procambarus clarkii*	Boomblad
Bird	Ringnecked parakeet	Halsbandparkiet	*Psittacula krameri*	Boomblad
Bird	Ruddy duck	Rosse stekelstaart	*Oxyura jamaicensis*	Boomblad
Terrestrial plant	Variable-leaved crestwort	Gaaf kantmos	*Lophocolea semiteres*	Boomblad
Terrestrial plant	Heath star moss	Grijs kronkelsteeltje	*Campylopus introflexus*	Boomblad
Aquatic plant	Water primrose	Kleine waterteunisbloem	*Ludwigia peploides*	Boomblad
Anthropod	Waterlouse	Waterpissebed	*Asellus aquaticus*	Boomblad
Anthropod	Killer shrimp	Pontokaspische vlokreeft	*Dikerogammarus villosus*	Boomblad
Insect	Horse-chestnut leaf miner	Paardenkastanjemineermot	*Cameraria ohridella*	Boomblad
Insect	Colorado potato beetle	Noord-Amerikaanse coloradokever	*Leptinotarsa decemlineata*	Boomblad
Insect	Weevils	Snuitkever	*Curculionoidea*	Boomblad
Mammal	American mink	Amerikaanse nerts	*Neovison vison*	Boomblad
Mammal	Reeves's muntjac	Chinese muntjak	*Muntiacus reevesi*	Boomblad
Mammal	Siberian chipmunk	Sibirische grondeekhoorn	*Tamias sibiricus*	Boomblad
Reptile/amphibian	Amerikaan stierkikker	American bullfrog	*Lithobates catesbeianus,* or *Rana catesbeiana*	EU directive
Mammal	Carolina fanwort	Waterwaaier	*Cabomba caroliniana*	EU directive

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Freshwater invertebrate	Chinese mittencrab	Chinese wolhandkrab	*Eriocheir sinensis*	EU directive
Mammal	Coypu/nutria rat	Beverrat	*Myocastor coypus*	EU directive
Bird	Egyptian goose	Nijlgans	*Alopochen aegyptiacus*	EU directive
Aquatic plant	Floating pennywort	Grote waternavel	*Hydrocotyle ranunculoides*	EU directive
Terrestrial plant	Giant hogweed	Reuzenberenklauw	*Heracleum mantegazzianum*	EU directive
Mammal	Muskrat	Muskusrat	*Ondatra zibethicus*	EU directive
Mammal	Pallas' squirrel	Pallas' eekhoorn	*Callosciurus erythraeus*	EU directive
Mammal	Raccoon	Wasbeer	*Procyon lotor*	EU directive
Freshwater invertebrate	Red swamp crayfish	Rode Amerikaanse rivierkreeft	*Procambarus clarkii*	EU directive
Fish	Stone moroko	Blauwband	*Pseudorasbora parva*	EU directive
Aquatic plant	Western waterweed	Smalle waterpest	*Elodea nuttallii*	EU directive
Freshwater invertebrate	Paalworm	Paalworm	*Teredo navalis*	Verbrugge dissertation
Bird	Japanese housecrow	Huiskraai	*Corvus splendens*	Verbrugge dissertation
Invertebrate	Asian tiger mosquito	Aziatische tijgermug	*Aedes albopictus*	Verbrugge et al. (2013)
Invertebrate	Citrus longhorned beetle	Oost-Aziatische boktor	*Anoplophora chinensis*	Verbrugge et al. (2013)
Terrestrial plant	Common ragweed	Alsemambrosia	*Ambrosia artemisiifolia*	Verbrugge et al. (2013)
Aquatic plant	Floating pennywort	Grote waternavel	*Hydrocotyle ranunculoides*	Verbrugge et al. (2013)
Mammal	Grey squirrel	Grijze eekhoorn	*Sciurus carolinensis*	Verbrugge et al. (2013)
Vertebrate	Pumpkinseed sunfish	Zonnebaars	*Lepomis gibbosus*	Verbrugge et al. (2013)
Freshwater invertebrate	Red swamp crayfish	Rode Amerikaanse rivierkreeft	*Procambarus clarkii*	Verbrugge et al. (2013)
Bird	Ringnecked parakeet	Halsbandparkiet	*Psittacula krameri*	Verbrugge et al. (2013)
Invertebrate	Asian tiger mosquito	Aziatische tijgermug	*Aedes albopictus*	Wilfred Reinhold
Vertebrate	Japanese housecrow	Huiskraai	*Corvus splendens*	Wilfred Reinhold
Mammal	Muskrat	Muskusrat	*Ondatra zibethicus*	Wilfred Reinhold
Bird	Ringnecked parakeet	Halsbandparkiet	*Psittacula krameri*	Wilfred Reinhold
Freshwater invertebrate	Quagga mussel	Quagga mossel	*Dreissena bugensis*	Wilfred Reinhold

Table 44. Overview of the species from different sources, from which we selected the 13 species focused on in chapter 5, as described in section 5.3

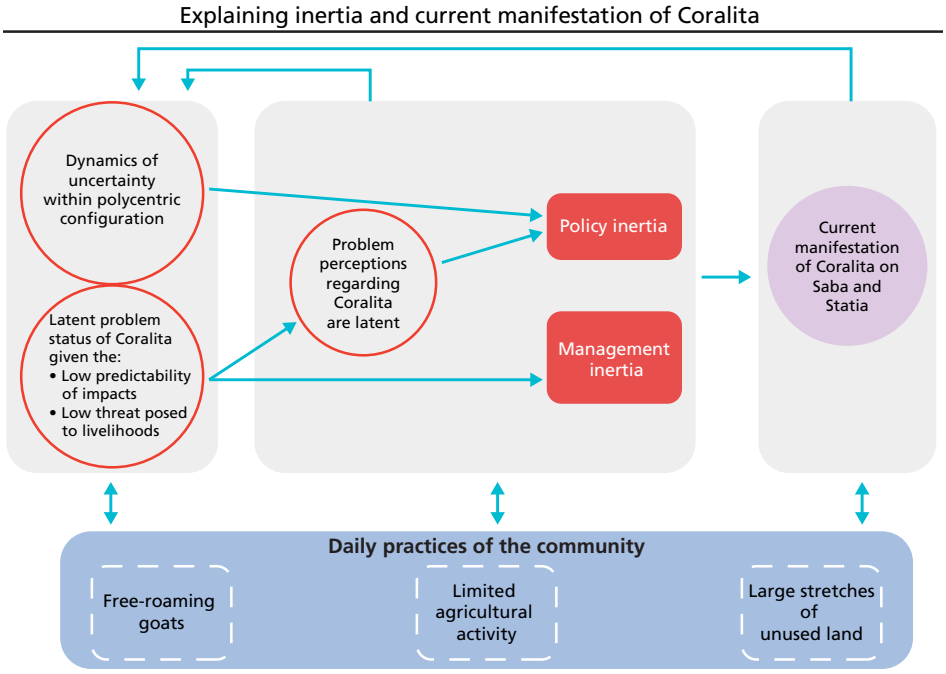
SAMENVATTING

Deze dissertatie komt voort uit verwondering over het gebrek aan actie betreffende een alom betreurd milieuprobleem, namelijk de invasieve uitheemse plant Coralita op St. Eustatius en Saba. Saba (13 km^2 en 2200 inwoners) en St. Eustatius (21 km^2 en 3300 inwoners) zijn sinds 2010 bijzondere gemeenten van Nederland, en hebben als Caribische eilanden zeer bijzondere natuur. Invasieve soorten vormen één van de grootste bedreigingen voor biodiversiteit (Díaz et al. 2019, Pejchar and Mooney 2009), en naar het lijkt een extra grote bedreiging op eilanden (Vilà et al. 2011, Reaser et al. 2007). Coralita (*Antigonon leptopus* (Hook. & Arn.)) komt oorspronkelijk uit Mexico, en is berucht als invasieve plant wegens de snelle groei en lastig te verwijderen wortels, die enkele meters diep kunnen groeien (Burke and diTommaso 2011). De eerste documentaties van Coralita op deze eilanden dateren uit 1902 (Boldingh 1909), en er zijn schattingen dat op St. Eustatius de plant inmiddels 15% tot 20% van het eiland bedekt (van der Burg et al. 2012). Daarmee vormt Coralita een bedreiging voor inheemse vegetatie en de bedreigde *Iguana delicatissima* (van der Burg et al. 2012), en maakt het de toch al beperkte landbouwactiviteiten nog lastiger. Desalniettemin is er sprake van inertie jegens de plant op beide eilanden, zowel wat betreft beleid als beheer. Coralita wordt in veel rapporten genoemd als bedreiging (bijvoorbeeld Coblentz 1980, Jongman et al. 2010, Smith et al. 2014), en het (verlopen) Caribische natuurbeheerplan 2013-2017 roept de eilanden tot beleidsvorming op (Ministerie van Economische Zaken 2013). Er is echter geen beleid, en ook de landeigenaren die hun afkeer jegens de plant graag uiten, verwijderen haar slechts sporadisch en plaatselijk. De **onderzoeksvraag** is dan ook: "Hoe kan de beleids- en beheerinertie jegens de invasieve uitheemse plant Coralita op Saba en St. Eustatius verklaard en verholpen worden?". De dissertatie draagt bij aan governance literatuur rondom milieuproblemen door een afwezigheid te analyseren: het niet-vormen van beleid betreffende, en het niet-beheren van, Coralita. Dit wijkt af van een meer gangbare focus op bestaand beleid en beheerpraktijken, waarmee het **onderzoeksdoel** is om "Besluitvorming met betrekking tot invasieve uitheemse soorten te stimuleren door beleids- en beheerinertie te begrijpen".

Waarom is er beleids- en beheerinertie met betrekking tot Coralita op Saba en St. Eustatius?
In hoofdstuk 2 wordt de governance configuratie van St. Eustatius (Statia) en Nederland vergeleken met die van Guadeloupe en Frankrijk, en met die van Anguilla en het Verenigd Koninkrijk. De Nederlandse configuratie is qua structuur polycentrisch, wat in theorie een gunstige verdeling van verantwoordelijkheden zou moeten zijn. In de praktijk heerst echter een onduidelijke verdeling van verantwoordelijkheden en mandaat binnen de polycentrische configuratie, die in het Franse en Britse geval veel duidelijker is. Dit is een verklaring voor de inertie wat betreft beleidsvorming, evenals de

in hoofdstuk 3 besproken afwezigheid van duidelijke belanghebbenden. Daar wordt de term "latent probleem" geïntroduceerd, die in hoofdstuk 4 verder gedefinieerd wordt als de combinatie van lage bedreiging voor het bestaan van een gemeenschap, en beperkt inzicht in de impacts van het probleem. Omdat de precieze impacts van Coralita voor natuur en mens onbekend zijn, maar er weinig dreiging voor de eilandgemeenschappen vanuit gaat, kunnen bewoners geen duidelijke positie innemen ten opzichte van de plant. Deze latente probleempercepties maken dat er geen druk is om beleid te vormen, en dragen dus bij aan de beleidsinertie.

De latente probleemstatus van Coralita draagt ook bij aan de beheerinertie, zoals besproken in hoofdstuk 4. Omdat het grootste deel van de eilanden in privaat bezit is (Schoenmaeckers 2010), kan het verwijderen of indammen van Coralita door landeigenaren een heel belangrijke rol spelen. Maar in hoofdstuk 4 wordt een aggregaat van dagelijkse praktijken geschetst, dat in inertie met betrekking tot Coralita resulteert, in stand gehouden door de latentie van het probleem. De praktijk van loslopende geiten, beperkte landbouw en grote stukken ongebruikt land betekent dat er nauwelijks beheer wordt ondernomen jegens Coralita. Figuur 1 geeft deze verklaringen voor inertie en de huidige aanwezigheid van Coralita weer.



Figuur 1. De factoren behandeld in deze dissertatie met betrekking tot Coralita op Saba en St. Eustatius, bestaande uit drie verklarende clusters (grijs) en een cluster van de dagelijkse praktijken.

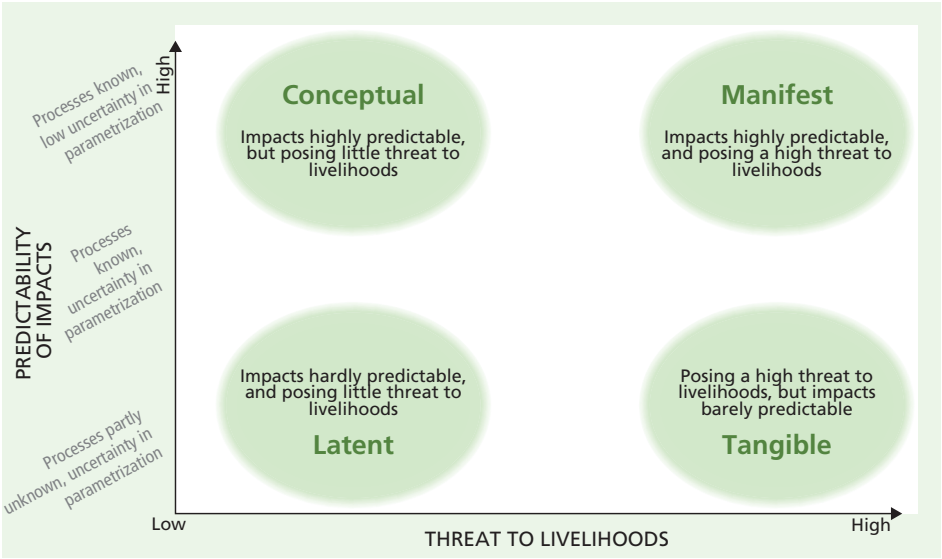
Hoe kan de beleids- en beheerinertie met betrekking tot Coralita op Saba en St. Eustatius verholpen worden?

Deze dissertatie biedt drie handreikingen om de inertie rondom Coralita op te heffen: het identificeren van de latente probleempercepties; het adresseren van een gelieerd manifest probleem; en routes van een latente naar een manifeste probleemstatus. In hoofdstuk 3 worden probleempercepties van Sabanen en Statianen met betrekking tot Coralita geïdentificeerd middels interviews volgens Q methodologie, toegepast op een typologie van landschapswaarden. Aan de verschillende rangordes van hypothetische impacts van Coralita op die landschapswaarden, werden per eiland drie samenhangende perspectieven ontleend. Die perspectieven hechten belang aan de natuur vanwege biodiversiteit, landbouw, diensten zoals water en energie of schoonheid; en Coralita's dreiging werd dus ook verschillend gedefinieerd. Deze perspectieven kunnen als basis gebruikt worden voor het betrekken van belanghebbenden bij beleidsvorming.

De tweede handreiking wordt gedaan in hoofdstuk 4, met de ontwikkeling van een aangepaste versie van participatief actie onderzoek voor latente problemen, genaamd PAR-L. PAR-L dient tot het opheffen van inertie binnen een gemeenschap betreffende een latent probleem, door aanpassingen in de dagelijkse praktijk te doen. Net zoals bij andere PAR-benaderingen wordt dit volledig in samenwerking met de lokale gemeenschap gedaan, en is het doel verbeteringen in hun dagelijks leven te bewerkstelligen. PAR-L beoogt daarnaast om door een manifest probleem aan te pakken, een daaraan verbonden latent probleem eveneens te verminderen. De methode werd op kleine schaal getest op Saba, waar door het planten van citroenbomen de praktijk van beperkte landbouw geadresseerd werd. Om zo het manifeste probleem rondom de zelfvoorziening in landbouw aan te kunnen pakken, moest Coralita uit dit gebied verwijderd worden, en dus een vermindering van het latente Coralita probleem opleverde. Middels PAR-L kan actie met betrekking tot een latent probleem gerealiseerd worden, middels een focus op een manifest probleem.

Hoofdstuk 5 onderzoekt een vermoeden dat in de voorgaande hoofdstukken vorm begon te krijgen: het tegenovergestelde van een latente probleem, namelijk een manifest probleem, gaat samen met minder inertie. Bij een latent probleem blijft actie uit omdat mensen er niet genoeg door geraakt worden, maar wat als ze er wel door geraakt worden? In literatuur over invasieve soorten wordt immers ook gesproken over zogenaamde "conflict soorten", waarbij er zoveel belangen spelen dat beheer en beleidsvorming bemoeilijkt worden. Deze spanning wordt in dat hoofdstuk onderzocht door de probleemstatus van 13 invasieve uitheemse soorten in Nederland te reconstrueren, op basis van het aantal krantenartikelen en Scopus-publicaties met betrekking tot die soorten. Daaruit bleek dat rondom soorten met een manifeste status er zowel meer conflict optreedt, als meer actie ondernomen wordt. Het is dus de moeite waard om Coralita van een latent probleem tot een manifest probleem te maken.

Voortbouwend daarop wordt in hoofdstuk 6 een derde handreiking voor het opheffen van inertie gedaan, namelijk door een probleem met latente status naar een manifeste status te verschuiven. In hoofdstuk 4 werd latentie geïntroduceerd als een kwadrant van een assenstelsel gevormd door de twee assen "bedreiging voor bestaan van een gemeenschap" en "inzicht in de impacts van een probleem". Op het laagste punt van die twee assen bevinden zich latente problemen, terwijl manifeste problemen op het hoogste punt van die twee assen geplaatst worden, zie Figuur 2. Hoofdstuk 6 stelt daarom voor om langs de twee assen te verschuiven door onderzoek te richten op de impacts van een latent probleem, en die te verbinden aan thema's die een samenleving raken. Daarvoor zou nauwe samenwerking met de gemeenschap binnen een PAR-L raamwerk geschikt kunnen zijn.



Figuur 2. Vier statussen die een milieuprobleem op een gegeven moment kan hebben.

Aanbevelingen voor Coralita-beheer op Saba en St. Eustatius

In hoofdstuk 7 worden praktijkgerichte aanbevelingen gedaan voor het beheer van Coralita op Saba en St. Eustatius. Het gaat daarbij allereerst om bewuste omgang met de plant, in plaats van het min of meer onbewuste gebrek aan beheer en beleid waar momenteel sprake van is. Vervolgens wordt het belang van het betrekken van de lokale gemeenschap onderstreept, en suggesties gedaan zoals buurtteams of maandelijkse opruimevenementen. Drie voorstellen worden gedaan: allereerst het ondersteunen van bewoners om Coralita in te perken in hun eigen tuin, bijvoorbeeld door tuinbouw te stimuleren. Ten tweede zou er een stuk Coralita gereserveerd moeten worden om te experimenteren met verwijder-methoden, zoals het gebruik van schaduw, begrazing

door varkens of geiten, en het planten van alternatieve begroeiing. Ten derde is het belangrijk op de schaal van het gehele eiland verantwoordelijkheden en budgetten te verdelen, de aanwezigheid van Coralita te monitoren, en gebiedsgerichte prioriteiten te bepalen. Voor beide eilanden worden gebieden aangewezen waar Coralita zo snel mogelijk verwijderd en vervangen met een andere plant moet worden, waar Coralita erosie verergert, en waar het in de gaten moet worden gehouden.

ACKNOWLEDGEMENTS

These acknowledgements cannot but start with attempting to express my boundless gratitude to the Bonaireans, Sabans, and Statians who made it possible for me to conduct this research at all, and have life-changing experiences in the process. There is so much you taught me, guiding me around your islands, opening your homes to me, and patiently participating in whatever survey, tree-planting pilot or brainstorm activity I came up with. The warmth with which you open the door to whoever visits your island never ceases to amaze me, and I can only hope you have gotten something from my presence as well. Balancing what is relevant to science and useful for you, was a continuous struggle, and not seldomly have I felt to be failing you. At more positive moments, I hope to have created some inspiration for dealing with Coralita and to have planted something in your minds and soil to contain that creeper.

Special Statia thanks goes to Hannah Madden, Clarisse, Theresa, and Pepita, Johan and everyone at CNSI for supporting my research efforts. To deputy government commissioner Stegers, Laura Heij and Anthony Reid for taking an interest and collaborating with our work. To Nadio and Jobo for hosting me at the botanical garden, and Miss Vilma Rivers for housing me. And of course to Hannah Fairley for sharing Sundays at the beach, sizzling pots at Yummy Tummy and extreme workouts at the gym.

Special Saba thanks goes to the Saban government, and specifically commissioner Wilson and Randall Johnson for facilitating the lemon tree project. Likewise to Sydney Sorton and Nadine Granger for making their land available for the shading experiment. To Anton, Raymond and Franklin for supporting my research, be it by watering trees, lending me the school cafeteria or showing me around the island. To the Lace Ladies for welcoming me to their group, and being patient with my complete lack of crafting skills (Mrs. Riley and Miss Peggy specifically). To Sherry and Larry, for providing Flamboyant cocktails and similar indispensable research support. To Pim, Jesse and Judit for putting their skills and knowledge to work for the benefit of Saba. Jens, thank you for sharing troubles and inspiration over coffee – those moments were very wholesome. Vito, it was extremely fun talking politics with you, but not becoming your PA was I think the best thing I could do for our friendship. La-Toya, thank you for dragging ignorant me along to epic dance performances, and I am happy to see our friendship develop under rainy Dutch skies. Esther (and Sugar), thanks for the strolls, picknicks at the beach and girl talk; it'd be great to have you closer. Lieve Sam and Mariëtte, you kept me extremely well-fed, entertained and loved whenever I stepped over your doorstep – thank you for being a home away from home. Tom and Heleen, your art and ecological knowledge always entice even more passion for the beauty of Saba's nature, and Tom never failed to patiently answer any ignorant question I would have. Dear Will and Lynne, thank you for opening your home to me, baking me a birthday pie, sharing coffees and explaining me

the intricacies of Saban life. And everyone I have not mentioned explicitly – life on Saba would not have been the same without you.

The first time I visited these beautiful islands, when the PhD journey had only just begun, was in the company of my personal ecologist Rockstar and the one I would not have wanted to do a PhD without: Elizabeth. Miss, I cherish all the post-dive fries, sunset cocktails, brilliant Coralita Girls merchandise ideas, work sessions at airports with reggae-lounge music, hikes up volcanoes and excited odes to some random piece of vegetation. It's probably the core of what I will remember of the PhD ten years from now. I am very grateful for all the patient explanations of basic plant stuff you gave me, and support as a fellow Coralita Girl, even when times were tough. You are an amazing lady, an extremely gifted botanist, and much too adventurous hiker. Looking towards the future, I can see us sitting on a beach, sipping cocktails, being splendid.

Back in Utrecht, articles would have to be written, which I could not have done without my supervisors Frank van Laerhoven, Martin Wassen, Mendel Giezen and Peter Driessen. There are plenty of horror stories about PhD supervisors: unavailable, unsupportive, or with a complete lack of sense for the human behind the candidate. I have not experienced any of that, getting all the support I needed, while always being allowed to take my research to whatever uncharted territory I wanted, and gently nudged back when too far off track. I am also very grateful for the arrangements that were made to deal with my delay. Although some may argue that is what an employer should offer, I know it not to be common within the PhD system, and am especially grateful for my supervisors for these arrangements.

Frank, if it weren't for you, I would never have thought to do a PhD. And against what you might expect, I feel that would have been a loss. Since me singing your praise live will make you even more uncomfortable than reading it here, I will save most for the defense. Suffice to say that morning coffee is the best rut a supervisor can grant his student, and the ease with which you let me get you annoyed, grumpy and/or uncomfortable made it all the better. I look forward to our weekly tequilas.

Martin, I know my stubbornness both amused and annoyed you, but let's say I learned it from the best. When the other three supervisors said A, you were never afraid to argue B, offering me the opportunity to have my pick. Although the last article may be the only one with some ecological substance, your feedback was always useful and showed real interest in my work. Thank you for the commitment to the Caribbean context, sincere expressions of appreciation, and telling me to go home.

Mendel, you leaving Utrecht was of course a great disappointment, but also the perfect excuse to flee the Van Unnik from time to time. The Amsterdam office offered a save haven, where your first question would always be how I was doing, and only then about

the research. You have a great talent for making that one remark or posing that one question that puts all confusion if not into order, then at least into perspective.

Peter, I have always admired – and in parts feared – your sharp mind, ability to disentangle mess I had created by thinking in circles for a week, and talent to point right at both the weak and strong spot of any written product you'd get in front of you. In a world governed by H-indices, Shanghai ratings and citation scores, you still manage to provide a comfortable environment in which a PhD can be the true learning experience it is intended to be. Thank you for the constructive advice, discussions about the academic system, and faith you had in me.

All other Copernicus colleagues, thank you for always being open to sharing your knowledge of fields of environmental research unknown to me, and being such a warm working environment. All the feedback you provided throughout the years on parts of this dissertation, helped immensely. Maarten Eppinga, thank you for supporting Elizabeth and me in all our work, arranging the grant money that facilitated it all, and never rejecting a beer. Rémon and Svenja, thank you for being great office buddies, and I forgive you for the mango tea and forced pastries. Annick, you were of course the light of the last six office months, and I hope we can continue the yoga tradition.

Een veldwerkperiode in de Cariben maakte me altijd extra bewust van hoe rijk mijn leven is, met prachtige mensen als vrienden. Lotte, het spijt me dat veldwerk het gezamenlijk kijken van The Royal Wedding II verstoorde, maar gelukkig heb ik wel jouw eigen bruiloft vanaf de eerste rang kunnen meemaken. Ons Interrail-avontuur heeft mij klaargestoomd voor het omgaan met vertragingen en extreme hitte – allen noodzakelijk voor een Caribische PhD. Je bent een enorm attente, trouwe en liefdevolle vriendin, en dat ik altijd op jou kan rekenen maakt moeilijke episodes een heel stuk lichter. Marijn, Valentijn, Jenno, Tom, Florentine en Lútsen, en mooie mensen van de Boerenbridge: geen betere reden (en soms de enige) om even pauze te nemen van het schrijfwerk dan om met jullie af te spreken. Grote Liefde (a.k.a. Somayeh), gelukkig kwam de schok dat je met een ander ging trouwen pas toen mijn dissertatie nagenoeg af was. Dank voor alle museumuitjes, giechelbuien en betrokkenheid – ik denk altijd de hele dag aan je! Ruben, of het nu een strandwandeling, etentje in de Holiday Inn of ontbijten op een station is: tijd met jou is altijd uniek. Eline en Carolien (a.k.a. Hübsche Hütte Heidi's), onze wandeltochten door Brabant, de Alpen en het Diakonessenhuis zijn de rustpunten waar ik naartoe leef, en gelukkig drinken we ook vaak genoeg wijn.

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je bent mijn allerliefste lastige Zusje, en ik ben heel trots je! Zeker gezien de moeilijke jeugd die we beiden hebben gehad. In belangrijke mate debet aan die moeilijke jeugd zijn Maarten en Joke, mijn lieve lawaaierige oom en tante. Ik kan me altijd tot jullie keren voor theater-tips, witte wijn, levensadvies, en dikke knuffels. Hugo, je bent een geweldige toevoeging aan de clan, en het onuitputtelijke enthousiasme waarmee jij de familie Vaas, en de vrouwen daarvan in het bijzonder, tegemoet treedt is bewonderenswaardig. Dat we nog maar lang de zorg voor mijn zusje mogen blijven delen. En dan de mater familias, de oma die mij wekelijks telefonisch adviezen geeft als "je bent niet het Rode Kruis": opa en jij zijn de beste grootouders die ik me heb kunnen wensen. Ik vind het heel bijzonder dat van het op schoot zitten, naar slapen in het stapelbed, eten van pannenkoeken en het rondrijden in je autootje, je nu ook bij mijn verdediging bent.

Endings are not my strong suit, so here is to this sentence being the continuation of a Caribbean-enriched life!

ABOUT THE AUTHOR

Jetske Vaas was born on the 14th of May 1990 in Naarden, and spent a very happy childhood in Almere. She completed gymnasium at Goois Lyceum in Bussum, complemented with a natural science program for the last two grades at Junior College Utrecht. Having found her alma mater in Utrecht University, she completed the Liberal Arts and Sciences bachelor's program with the majors Environmental governance, and Developing countries and sustainability. Finding the latter theme more urgent, she enrolled in the master's program International development studies at Wageningen University from which she graduated *cum laude*. As part of the track International development diplomacy she did an internship at the Ministry of Foreign Affairs and Cult of Costa Rica. Having grown fond of the Ticos and their beautiful country, she decided to write her master's thesis there as well, on the payment for environmental services scheme more or less imposed by the World Bank, to the detriment of campesinos and the forest alike.

During her PhD she remained motivated to make science contribute to local communities, hence participating in Sea&Learn on Saba, giving presentations at CNSI on Statia, writing blogs for the KNAW's Faces of Science, and arranging internships and thesis research for students on erosion control and Coralita management for Saba.

Finding she enjoyed working with locals more than writing scientific articles, Jetske currently works at engineering company Witteveen+Bos on stakeholder engagement with dyke reinforcement programs. She lives in Utrecht, waiting for zero-emission flights to the Caribbean so she can regularly check up on Coralita.

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Absent action or crippling conflict? Moving from latency to a manifest problem: trajectories across scientific and public salience. *Under review at Environmental management*.

ABOUT THE CORALITA GIRLS

Once you have t-shirts, you're an institution. People on Saba and Statia had taken to calling Elizabeth Haber and Jetske Vaas "the Coralita girls", and so they decided to adopt that name. T-shirts were printed, a Facebook page opened and a brand established. The Coralita Girls aimed for interdisciplinary research, accessible for and of use to Saban and Statian community. They gave presentations on invasive alien species to various types of audiences; visited schools and after-school programs to let students be an ecologist for a day, playing around with GPS and measuring tapes. Wanting to set an example, they organized clean-up events during which Coralita was cleared from trees. And they facilitated each other's work: Elizabeth for example by equipping Jetske with maps and basic plant knowledge to conduct surveys and interviews, and Jetske providing Elizabeth with understanding of e.g., land use dynamics affecting the spread of invasive alien plants. They have many ideas for further Coralita Girls activities, such as sailing the Caribbean sea and conducting Coralita clean-ups on every island they visit.

The invasive alien Coralita vine (*Antigonon leptopus*) covers large stretches of Saba and St. Eustatius (Caribbean Netherlands), posing a threat to agriculture and the unique nature of these islands. Despite widely held resentment regarding the vine, policy and structural management approaches are lacking. This dissertation tries to understand the inertia regarding Coralita, and in doing so elicits characteristics that render the vine on Saba and St. Eustatius a latent environmental problem. It also offers handles to overcome the inertia, by linking Coralita to the more manifest problem of waning agricultural activity. Both problems are embedded in a community's daily practices, and in working with locals to adjust such practices, Coralita can best be addressed.