

Governance of ecosystem services on small islands: three contrasting cases for St. Eustatius in the Dutch Caribbean

Nico Polman
LEI Wageningen UR
The Netherlands
nico.polman@wur.nl

Stijn Reinhard
LEI Wageningen UR & Wageningen University
The Netherlands
stijn.reinhard@wur.nl

Linde K.J. van Bets
Wageningen University
The Netherlands
linde.vanbets@wur.nl

and

Tom Kuhlman
LEI Wageningen UR
The Netherlands
tom.kuhlman@kpnmail.nl

ABSTRACT: Natural ecosystems provide an attractive focus for tourism on small islands. However, at the same time tourism and other human actions can be detrimental to these ecosystems especially because governance of the ecosystem may be difficult due to the limited resilience of small island ecosystems. In this paper, we focus on the conditions under which self-governance will be the appropriate governance mechanism of ecosystem services on small islands. We apply Ostrom's (2009) framework for common-pool resources in a social-ecological system, and select the relevant indicators for small islands. We scored these indicators for three cases (environmental issues) in St. Eustatius, a Caribbean island under Dutch rule. These cases show that self-organization of ecosystem services is not an outcome easily achieved. The unevenly distributed benefits of potential measures are found to decrease community support of measures that could reinforce these ecosystem services.

Keywords: governance, self-organization, small island, ecosystem services, Caribbean, environment

© 2016 – Institute of Island Studies, University of Prince Edward Island, Canada

Introduction

Many ecosystems worldwide are threatened by human activities. Ecosystems on small islands, which often harbour a high degree of biodiversity and endemism, are particularly vulnerable due to the small size of species populations and low genetic variation (Paulay, 1994). Even if

ecologists have selected such measures as would help to protect these ecosystems, implementing those measures is often fraught with problems (Bass & Dalal-Clayton, 1995, pp. 22-23). These problems belong to the realm of governance: how people organize themselves so as to achieve a desired outcome. This paper asks what the prospects are to maintain or even enhance essential ecosystem services through a combination of self-governance (defined as civil-society groups setting their own rules for joint management of resources) and government regulations in a setting where the problems of small tropical islands are particularly pronounced. The related research questions are: how to identify the relevant indicators important for successful self-organisation and how to make these indicators operational. We shall see how on small islands ecosystems are not only different, but also how self-governance there has its own peculiarities: positive as well as negative.

The concept of ecosystem services has been developed precisely to deal with the problem of how to protect ecosystems from a governance point of view. Ecosystem services are defined in terms of their utility to humans (Costanza et al., 1997; Daily et al., 1997), the idea being that if it can be shown how important ecosystems are to our wellbeing (and indeed our survival), this will increase public support for their preservation. Quantifying that importance in terms of monetary value can help to justify policies for protecting said ecosystems. Four types of ecosystem services are distinguished: provisioning (supply of goods that humans need, such as food or minerals), supporting (e.g. pollination), regulating (e.g. water buffering, waste recycling) and cultural (e.g. the joy and knowledge derived from observing nature).

Ecosystem services often have the characteristics of public goods, in that they are non-excludable (a person who refuses to pay for the good can still have access to it) and non-rivalrous (one person's consumption does not reduce the amount available to others). In this they differ from 'private' goods such as, for instance, bread, which once consumed is no longer available to others, and which can be refused to those who will not pay for it. Public goods represent a market failure: in a free market, less of them will be produced than are desired by society (Cornes and Sandler, 1996). This is why some institution other than (or in addition to) the market is needed to ensure the appropriate amount of the good in question. Government intervention is one option, but sometimes voluntary organizations are more appropriate. Both are intricately tied to the concept of governance.

In this paper, insights from ecology and economics are brought together in order to arrive at feasible governance solutions for the sustainable utilization of ecosystem services. We apply the framework proposed by Ostrom (2009) on the self-governance of complex social-ecological systems (SES). An SES consists of an ecosystem together with the human actors using its associated ecosystem services, and the institutions governing the behaviour of those actors within the ecosystem. To our knowledge, this framework has not previously been applied to small island settings, which are a good example of SES because small islands are very dependent on their unique natural resources/ecosystem for their subsistence and livelihood. Hence our objective is to examine how this framework enables governance of different ecosystem services at a small island like St. Eustatius. We analyse what institutional arrangements are feasible for protecting ecosystems, or more precisely, how these institutional resources can be managed in such a way as to generate maximum benefits (i.e. ecosystem services) for the foreseeable future.

In order to study ecosystem governance on a small island, we chose a case where the peculiar characteristics of such a setting stand out starkly. St. Eustatius in the Caribbean is

such a case. Firstly, it is very small indeed: only 21 km², and with 3,500 inhabitants. Secondly, natural resources in the form of marine life, an attractive landscape and terrestrial biodiversity are highly important assets for the population (Kerkhof, Schep, Beukering, Brander, & Wolfs, 2014). Thirdly, these resources are under serious threat (Rojer, 1997). Three specific environmental issues are studied, which are crucial for the wellbeing of St. Eustatius' inhabitants:

- The role of natural resources in tourism;
- The grazing of goats in the wild;
- Fishing for conch, a sea snail which is in danger of being overexploited.

These three issues are studied in the following sections. The first develops our theoretical framework, specifies how it should be adapted to small islands, and identifies indicators for analyzing the three cases. The next section describes the cases in detail. This is followed by a brief description of the study method. Subsequently, this framework is applied to address respectively the resource systems and the users in the case studies. Finally we draw conclusions on the potential for self-organization on St. Eustatius and discuss options to improve on the capacity for self-governance of ecosystem services.

Theoretical framework

The first step is to identify the ecosystem services that need to be preserved. In the case of St. Eustatius, we chose examples of provisioning (conch, pasture for goats), regulating (preventing erosion and surface runoff) and cultural services (tourism) for study. They provide a good mix of different types of ecosystem services involving local stakeholders and the interaction of different resources within the context of self-organization. The next step is to determine to what extent these are public goods.

The distinction between public and private goods (i.e. those that can easily be traded in the market) is not always a clear one, and this is also the case for the ecosystem services considered here. Public-good characteristics are often a matter of degree, and whether a good is 'public' or not sometimes depends on the observer's judgment. Many people, for instance, can enjoy a beach (non-rivalrous consumption), but beyond a certain threshold higher visitor density will reduce the pleasure of beach experience (e.g. Debrot, Wentink, & Wulfsen, 2012) still available to the remaining users. In some cases, only one of the two criteria of non-rivalry or non-excludability applies. The same beach may have free access (non-excludability), but a competent authority may decide at a certain time to charge entry fees. In public-goods theory, these are named 'club goods': consumption is non-rivalrous (until the point where congestion appears), but it is excludable.

Achieving coordination between different stakeholders in the management of ecosystem services is a complex and challenging task. Different types of institutional arrangements are needed to govern the ways in which stakeholders can "co-operate and/or compete" (Davis and North, 1971). Such arrangements may be formal or informal, temporary or permanent. The arrangements may involve a single stakeholder, a group of stakeholders co-operating, or a government agency (alone or in co-operation with others).

Blanco (2010) argues that non-extractive uses of natural resources are dominant for tourism and that they are part of the product tourism firms sell. His focus is on voluntary action in the management of common-pool resources (CPR). CPRs include "natural" and

human-constructed resources in which (i) exclusion of beneficiaries through physical or institutional means is especially costly, and (ii) exploitation by one user reduces resource availability for others (Ostrom, Burger, Field, Norgaard, & Policansky, 1999). In other words, a CPR is a good which satisfies one of the two criteria for a public good, namely non-excludability, but not the other one (non-rivalry).

The next step is to examine how the governance of such CPRs can be achieved in a social-ecological system (SES). Empirical studies in diverse disciplines have found that users of common-pool resources often invest in costly governance systems to increase the likelihood of sustaining those resources (Blanco, 2010; Ostrom, 2009). For instance, when the expected benefits of maintaining the attractiveness of a tourist destination to the providers of tourist services exceed the perceived costs, the probability of said providers to organize themselves is high. However, these joint benefits do not necessarily lead to effective and efficient institutional arrangements. For this, it is important to consider the different scales of ecosystem services, as well as the distinct and autonomous property rights of stakeholders (de Blaeij, Polman, & Reinhard, 2011). Some benefits of governance are internal to the group, such as cost savings in the organization and administration of group activities; others, such as the preservation of a tourism destination, are external to the group (see also Polman and Slangen, 2008).

In practice, developing appropriate management of natural resources will take time and allow stakeholders to shape this development process. Jordan (2014) argues that communities can attempt to limit, control or encourage such processes. In ecosystem governance, participatory processes have become popular (Folke, Hahn, Olsson, & Norberg, 2005). These approaches involve activities such as stakeholder meetings and workshops involving different actors. The interactions in [Figure 1](#) illustrate these activities. Adaptive governance of development processes for natural resources typically focuses on experimentation and learning (Folke et al., 2005). Within such processes, entrepreneurs and leaders of NGOs and local communities will play an essential role, together with the networks (involving social relations with citizens) in which they operate. The outcomes of these governance processes can be described in terms of information shared among users, conflict resolution mechanisms among users, investment activities, self-organizing activities and network activities.

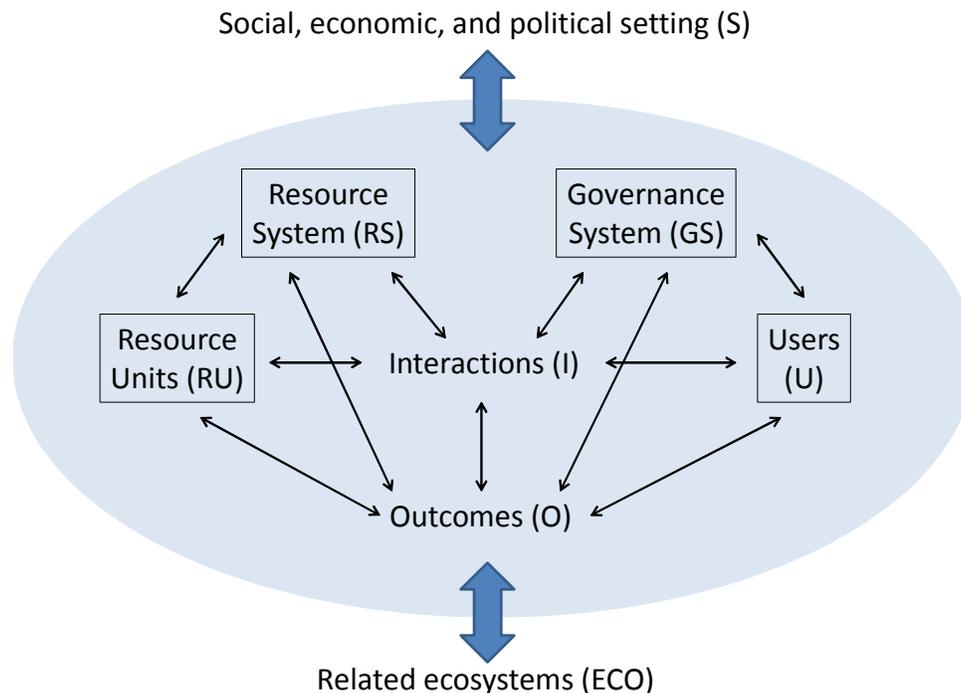
Ostrom (2009) developed a general framework in which she identifies four core subsystems within a SES ([Figure 1](#)). Each of these contains a number of variables that affect the likelihood of self-organization in efforts to achieve sustainability. An SES can be seen as a multi-scale system of which tourists, citizens and entrepreneurs are all part (Veldkamp, Polman, Reinhard, & Slingerland, 2011). We apply this framework to identify a common set of potentially relevant variables to the provision of ecosystem services in our three case studies. The variables are those that affect the success of particular policies in achieving sustainability in specific types and scales of resources. The four subsystems in [Figure 1](#) interact with each other and with the linked social, economic, and political settings as well as the related ecosystems and cultural landscapes (first-level core subsystems).

- Resource systems refer to areas containing sets of important natural resources (forests, coastal areas, etc.).
- Resource units are particular valuable resources located there, such as water, timber or fish. We may equate these with ecosystem services.

- Governance systems include government bodies, private firms and non-government organizations which control the management of the resource systems, for instance through rules of access.
- Users are those who benefit from the ecosystem services delivered by the resource unit. Benefits include food provision, recreation, or even commercial activity.

Each of these core subsystems is made up of multiple second-level variables, for instance the size of a resource system, the mobility of a resource unit, the level of governance, or users' knowledge of the resource system (Ostrom, 2009). Additional second-level variables pertain to the other elements in [Figure 1](#): the interactions between the subsystems (e.g. harvesting levels of diverse users), their outcomes (e.g. sustainability), related ecosystems (e.g. flows from these into the local SES), and the social, economic and political settings (e.g. economic growth).

Figure 1: The core subsystems in a framework for natural resources. (The arrows show relationships). Based on Ostrom (2009).



The selection of these second-level variables for analysis (from the large set provided by Ostrom) depends on the particular question under study, the type of SES, and the spatial and temporal scales of analysis. Ostrom (2009) distinguished ten of them which frequently affect the likelihood of users' employing self-organization as a means to manage a natural resource. These variables, listed in [Table 1](#), are used in analyzing our cases.

Table 1: Ten second-order variables related to self-organization (Ostrom, 2009).

Resource system (RS) RS3= Size of resource system RS5= Productivity of system RS7= Predictability of system dynamics	Governance system (GS) GS6= Collective-choice rules
Resource Units (RU) RU1= Resource unit mobility	Users (U) U1= Number of users U5= Leadership/entrepreneurship U6= Norms/social capital U7= Knowledge of SES/mental models U8= Importance of resource

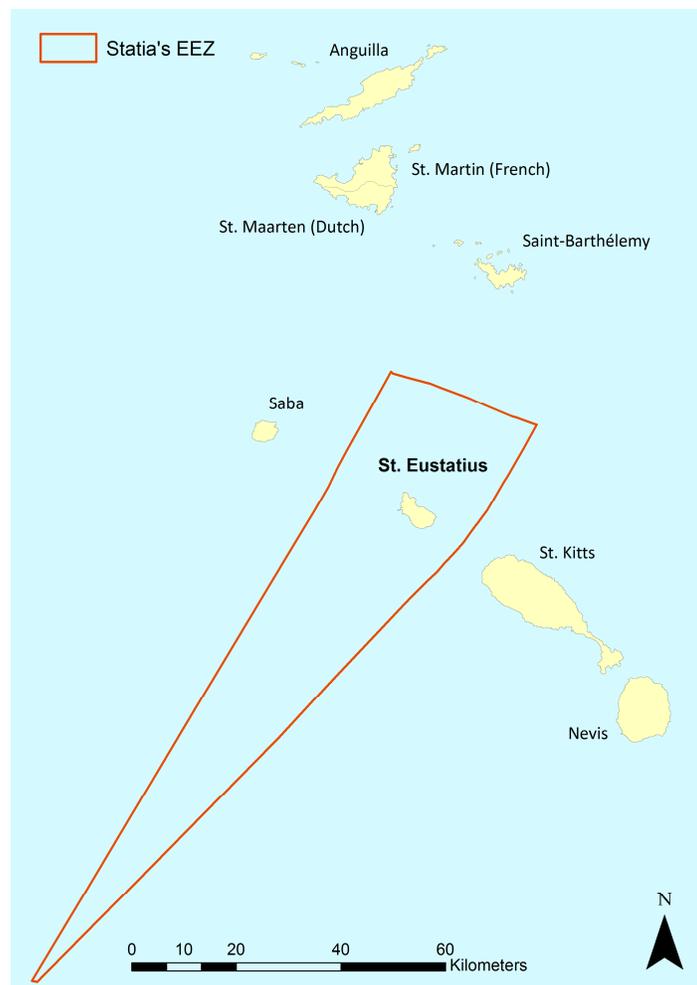
When applying this framework to a small island, particular characteristics need to be taken into account. Firstly, in a small community the number of stakeholders is limited, which makes self-governance easier. For the Dutch Caribbean, this has been suggested before by Debrot and Sybesma (2000). Transaction costs are lower, because actors often know each other and have information on the trustworthiness of other actors. However, small communities also imply a scarcity of management skills: the more so as highly trained people tend to move away from isolated communities towards large urban areas. This makes it more difficult to exert influence over processes of environmental management. The concomitant chronic shortage of capacity has for instance long been identified as the key constraint to effective natural resource management throughout the Caribbean (ECLAC, 1998). Generally, governance of small islands is affected by their lack of control over many of the issues facing them, which tend to be determined by external forces (Briguglio, 1995). This may be further complicated where the island in question is an overseas territory of another country, as is the case for a number of islands in the Caribbean and in the Pacific. Another problem of small communities (not necessarily islands, although there it applies *a fortiori*) is that the very fact that everyone knows everyone else means that conflicts of interest for public officials can easily arise (ICAC, 2001). Furthermore, small islands (except those who rely mostly on subsistence activities) tend to be economically vulnerable: they usually depend on a small number of economic activities (tourism, fishing), and a decline in one of them can trigger a major socio-economic shock (Hay, Suarez, Wong, Briguglio, & Ragoonaden, 2001). This is further exacerbated by the inevitable competition between residents and tourists for the same limited natural resources, especially for coastal land (Albuquerque and McElroy, 1992).

The case

St. Eustatius belongs to the Lesser Antillean island chain in the Eastern Caribbean. Formerly a Dutch colony, from 1954 to 2010 it was part of the Netherlands Antilles, an autonomous 'land' within the kingdom of the Netherlands. That entity was abolished in 2010, with three of the five islands becoming 'lands' in their own right and the other three (the smallest in terms of population) being incorporated into the Netherlands as 'special municipalities', meaning much less autonomy than before. (Aruba had already become a separate 'land' in 1986.) St. Eustatius is not only small but also relatively isolated: its closest neighbour, the island of St. Kitts is 13 km to the southeast (Figure 2), is part of a different state and therefore has limited

exchange with St. Eustatius. Its other close neighbour is the island of Saba at 27 km; Saba is also a special Dutch municipality, but is even smaller. Other neighbours in relatively close proximity include St. Barthélemy (a French dependency); St. Martin (half of which is French and the other half an autonomous entity within the kingdom of the Netherlands); and Anguilla (a British dependency). Most interaction takes place with the Dutch part of St. Martin: air travel, shipping and trade pass through there. This illustrates the fragmented governance of the Caribbean region, a consequence of the region's colonial history. As can be seen on the map, the natural capital of the island associated with the marine exclusive economic zone (EEZ) is large compared to the size of the island itself. In this study, however, we concern ourselves exclusively with the nearshore marine resources, to a depth of 30 metres. Since depth increases rapidly from the coast, this resource system is located in the immediate vicinity of the island. The deep waters have few exploitable resources.

Figure 2: St. Eustatius and its neighbours. (Source: VLIZ, 2014).



The most important economic activities on the island are government services, tourism and oil storage. Fishing, animal husbandry and agriculture have mostly a leisure and subsistence character, but there are also a few horticultural enterprises on the island and conch fishing is commercial.

Tourism, conch fishing and free-roaming livestock together constitute the main ecosystem services of the island. They are interconnected: soil erosion, caused by goats, and fishing for conch both impact on the marine ecosystem, which is a prime resource for tourism. The latter can also negatively affect the same ecosystem, for instance by damaging the coral reef. However, the three cases not only compete with each other but can potentially also affect the other in a positive sense. For instance, local conch and goat products may be used to make the island more attractive for tourism. This potential synergy is part of our analysis.

The total economic value (TEV) of ecosystem services in St. Eustatius has been calculated at US\$ 25 million per year, equivalent to 25% of GDP. Of this, the total financial value (TFV) amounts to about US\$ 3.7 million per year of which half is attributable to tourism value (van de Kerkhof et al., 2014). TEV refers to the valuation of the wellbeing derived from the ecosystem services, whereas TFV signifies the amount of money income generated by those services.

In view of the current profile of the island economy, tourism has been identified as having potential for growth (Strategic Development Plan St. Eustatius; van der Velde et al., 2010). Tourists vacationing on the island (e.g. relaxing on the beach, diving and hiking) and pensioners enjoying their golden days for longer stays will increase the demand for care and wellness facilities, as well as for food and other amenities. A growth in visits to the island will create an increasing demand for energy, communication and recreational and hospitality facilities. In the current situation, with a limited supply of beds, the island is of little interest for travel agencies to include in their programmes. Tourism on St. Eustatius is still hardly developed, compared to many other Caribbean islands, although it does provide a significant proportion of incomes on the island (Albuquerque and McElroy, 1992). Presently, a visit to the island is relatively expensive, caused, among other factors, by the absence of direct flight connections to markets in the USA and Europe. Tourists have to make an extra effort and costs to reach the island from the nearest hub, St. Martin. Compared to other Dutch islands in the Caribbean, relatively few tourists arrive per ship. Large cruise ships cannot dock at St Eustatius. However, it does have a protected harbour with moorings for small vessels. The 650 small vessels visiting the island in 2014, including motor boats, yachts and a small cruise ship, carried 3700 tourists. The most common nationalities of the vessels were American, French and Dutch. In 2014, nearly 11,000 tourists visited St. Eustatius (CBS, 2014). This is roughly the same as in 2013 and a little lower than in 2012. The average length of stay of this group in 2014 was 9.7 nights, one night shorter than the 10.7 nights in 2013.

In order to be sustainable, the development of tourism needs to remain within the carrying capacity of the island (see [Figure 3](#)). With the establishment of the Caribbean Netherlands Science Institute on the island, scientific tourism is a recent development with considerable promise for the island. In scientific tourism, conditions are created to facilitate scientific studies on the rich natural and cultural heritage of the island. This track has been previously pioneered successfully in the Dutch Caribbean on Curacao with the recent upgrade of the Carmabi Foundation research station. By providing logistical support to such specialist niche tourism, researchers, students, and university field courses are lured to the island.

Figure 3: Stylised model of tourist case.

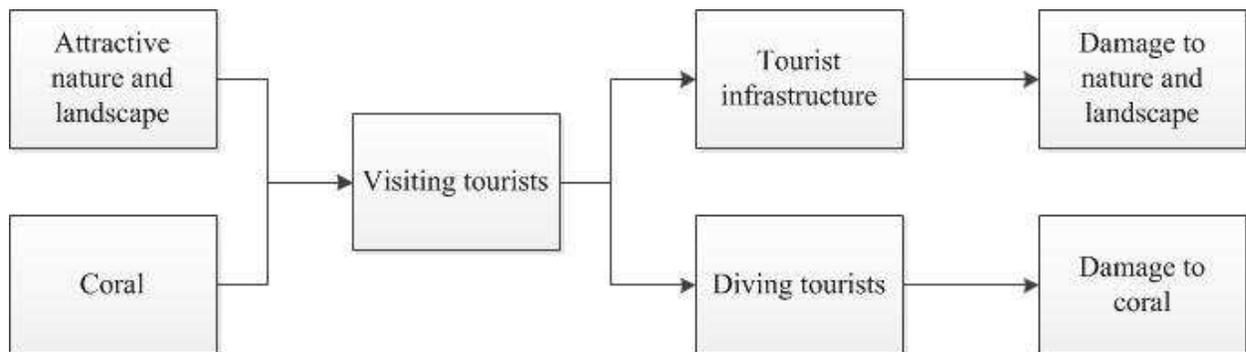
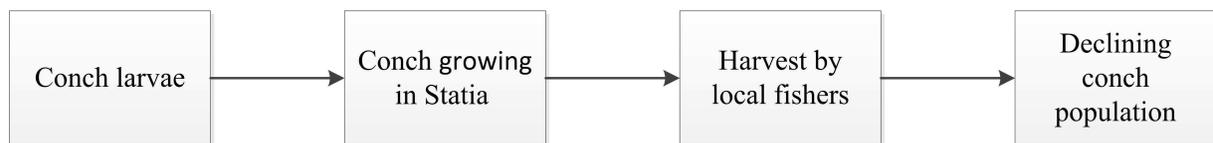
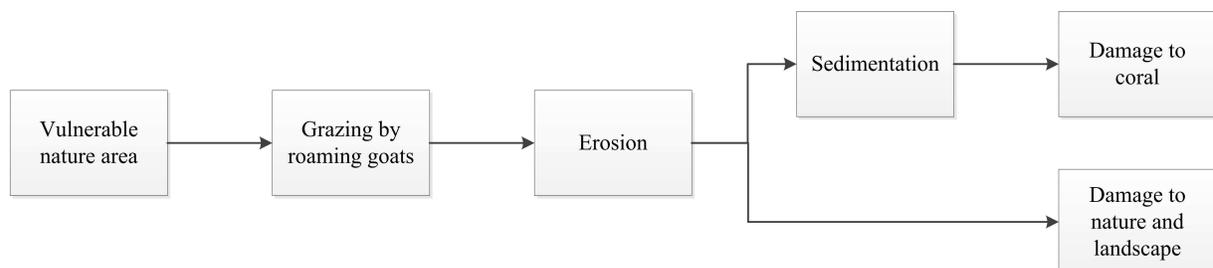


Figure 4: Stylised model of conch case.



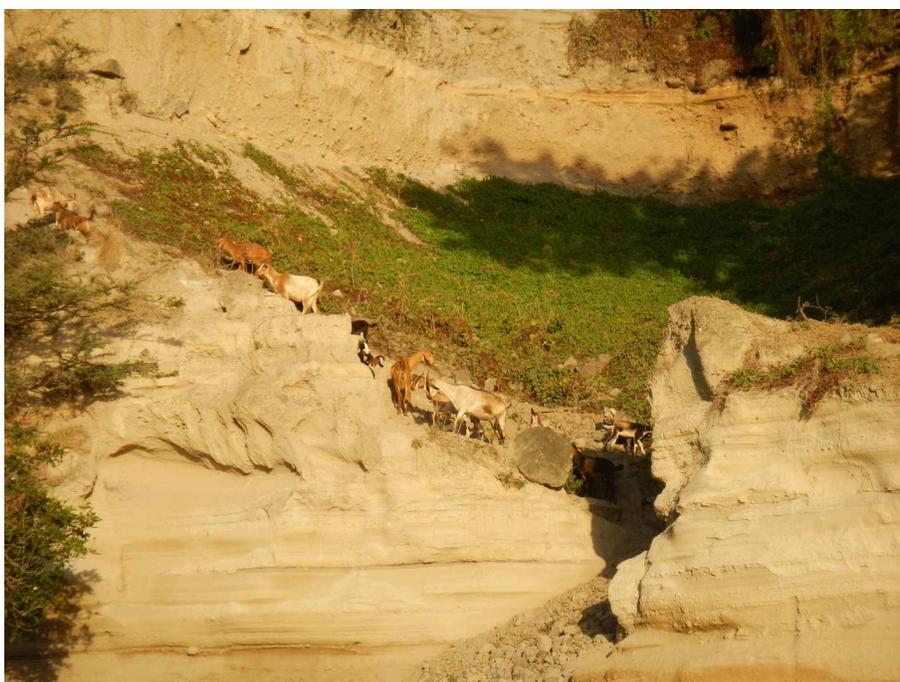
The queen conch (*Lobatus gigas*), while not rare, has been overfished in many areas of the Caribbean and hence its populations are in decline. Therefore it has become a protected species under the Convention on International Trade in Endangered Species (CITES). This treaty restricts the international trade in conch meat – although not prohibiting it. A conservation programme for conch would require limiting the capture of juveniles before they reach sexual maturity, as well as protecting the seagrass beds which are their habitat. The coral reef is important to conch in that it provides protection to the shallow seagrass beds in which they live. The principal goal of conserving conch is for conch to remain a source of food for the island and its visitors for the foreseeable future (see Figure 4). In addition, it may be possible to export conch meat, in which there seems to be a growing interest (DLG, 2011). Both seagrass beds and coral reefs are of very high importance to the ecology of the nearshore ecosystems; Caribbean coral reefs, moreover, are generally very vulnerable (Vicente, 1996).

Figure 5: Stylised model of goats case.



Grazing by roaming goats has been a problem throughout the Netherlands Antilles for many decades if not centuries. For 2010, it is estimated that some 6,400 animals (goats, sheep, cows, pigs and donkeys) roam freely (Cado van der Lely, Warning, Schep, van Beukering, & Wolfs, 2014). Goats, of which there are a few thousand (Debrot et al., 2015), are the most damaging, wandering all over the island and grazing the native vegetation, thereby causing soil erosion (see Figure 5&6). Trampling by goats as well as other herbivores adds to the problem (Fenkl et al., 2014; DLG, 2011). Additional concerns are traffic hazards and public health risks (DLG, 2011). For the owners (or those with a claim to ownership) this way of unfenced and unmanaged livestock-keeping is attractive: it requires little cost in terms of labour, feeding or fencing; this makes the returns, while very low, still positive even when most owners do not have sufficient land to graze their animals otherwise (DLG, 2011).

Figure 6: Erosion by goats in the Lower Town cliffs endangers the integrity of buildings and historical structures at the top edge of the cliff (Photo by Dolfi Debrot).



Method

The values of the relevant variables related to self-organization for St. Eustatius need to be collected. Recently, several studies on the value of ecosystem services were carried out on St. Eustatius (e.g. Cado van der Lely et al., 2014; Fenkl et al., 2014; van de Kerkhof et al., 2014; Tieskens, Schep, van Beukering, van Beek, & Wolfs, 2014). These reports contain information on the resource system and resource units (see [Table 1](#)). The principal remaining data required to answer our research question within the chosen theoretical framework are the attitudes and perspectives of stakeholders in these assets. These stakeholders are diverse: they include local inhabitants, but also entrepreneurs from abroad with assets on the island, as well as government agencies. Therefore, it was decided to carry out complementary interviews with experts and stakeholders focusing on the governance system and users (see [Table 1](#)) of these ecosystem services. In total, 19 semi-structured face-to-face interviews were carried out on St. Eustatius addressing the issues of pride in the island and its natural environment, opportunities

for benefiting from ecosystem services, concerns and threats as relating to the socio-ecological system of St. Eustatius. Different groups of stakeholders were identified depending on their role in managing ecosystem services: three representatives were from the harbour complex (including private enterprises), five were government representatives, two were from local (non-tourism) business enterprises, three from tourism-related enterprises (e.g. dive shop, tourism office), three from the nature management sector, and three from the scientific research sector.

Results

Physical resource system of the case

In this section we describe the second-order variables of the resource system and the resource units (see [Table 1](#)) for the three cases distinguished in this paper and the synergy between them. The principal features are summarized in [Table 2](#).

The size of the resource system is important in that large territories are unlikely to be self-organized Ostrom (2009). This aspect therefore differs per case and ranges from only a few hectares to the island as a whole. Defining area boundaries for each of the cases is difficult, but the main areas for tourism in St. Eustatius are the human settlements, the coastline and the nearshore area. For livestock, these include all land outside the settlements and the fenced horticultural area, whereas for conch, it is the near-shore seagrass beds to depths of 30 m. However, monitoring usage patterns and acquiring knowledge on the status of the ecosystem are important to all three cases.

In order to develop successful self-organization, users need to observe that they must sacrifice something with respect to the resource (Ostrom, 2009). This variable is related to the productivity of the resources system (RS5).

Table 2: Characteristics of the resource system.

	1	2	3
	Tourism	Gathering conch	Grazing livestock
Size of resource system (RS3, km ²)	21	Seagrass area under water	<21
Productivity of system (RS5)	low	low	moderate
Predictability of system dynamics (RS7)	high	low	high
Resource unit mobility (RU1)	low	low	moderate

Ostrom (2009) labels the extent to which the systems dynamics are predictable for users ‘Predictability of system dynamics (RS7)’. This is important for estimating what will happen if particular rules for the use of a destination are implemented. Predictability of the systems on St. Eustatius depends on the specific resource system. For tourism and roaming goats predictability of system dynamics is relatively high, given the rather long experience with these systems. For gathering conch predictability is low, given that they are endangered and their future depends on effective protection. Unpredictability in weather (e.g. hurricanes and droughts) negatively affects the interest of local residents to participate in agriculture (Cado van der Lely et al., 2014). Climate uncertainty will also affect predictability of the three cases in the short and medium run. Furthermore, the potential occurrence of an oil spill is seen as a main threat to both conch and the coral reefs of St Eustatius; such spills occurred in 1992,

2002 and 2004 (Singh, 2008; Klok, Debrot, Meesters, Stapel, Slijkerman, 2011)). Knowledge on stocks and sustainable harvest of conch is limited (DLG, 2011).

Resource unit mobility (RU1) refers to whether the elements in the resource system are able to move from one place to another. For instance, wildlife is mostly mobile, whereas plants are stationary (Ostrom, 2009). Resource unit mobility on St. Eustatius ranges from low to high depending on the ecosystem service involved. The location of conchs and tourists is relatively stationary. This implies lower costs in managing the resource and makes self-organization more likely. High resource-unit mobility for free-roaming livestock will negatively affect the potential for managing this resource through self-governance.

Governance systems and users

Variables linked to governance systems and users are presented in [Table 3](#). The first variable is labelled ‘Collective-choice rules (GS6)’. If users participate in a process of collective decision-making to craft and enforce some of their own rules to improve the sustainability of the resource, they face lower transaction costs as well as lower costs in defending the resource against others (Ostrom, 2009). “Field research confirms that the temptation to free-ride on the provision of collective benefits is a universal problem” (Ostrom, 2000, p. 138). It is expected that the free rider problem is less acute on a small island. However, our cases score low on this variable because many actors are not considered legitimate for enforcing rules, implying that users’ ability to enforce their own rules is limited (also Blanco, 2010).

The cases differ in the number and type of users involved (U1). The group size (number of users) is important for transaction costs of self-organization. Larger groups tend to have higher transaction costs of governance (Ostrom, 2009). The tourism case involves more users than the other individual cases.

The interviews demonstrate that human capital in the sense of leadership and entrepreneurship is a limiting factor (U5). This was also raised as bottleneck by the Economic Commission for Latin America and the Caribbean (ECLAC, 1998):

The real problem is leadership. Everybody wants to be a politician (for the money), not a leader. In the last 4 years, we had a new commissioner every six months. That is how people are here, there are new elections, political parties change all the time or coalition governments break up. This sets back businesses as we have to figure out who is in charge. You need leadership. (Entrepreneur, long-term resident, over 20 years, from abroad).

Residents from abroad stay for a relatively long period on the island and are interested in playing a leading role in development of the island. However, connection to more local initiatives is often difficult which implies that the issue is not solved through input of human capital from abroad as interaction between people born in St. Eustatius and residents from abroad is limited. As a resident from abroad explains,

The local community is great, but there is a dichotomy between foreigners or people who continuously go off and on the island, even if they grew up on St. Eustatius, and the local community. They live rather separately. It is hard to break this barrier. There used to be a medical school. Medical schools contributed to the local economy by buying groceries and driving cars, but they did not invest in community engagement,

as they come and go and they study hard. Locals would not invest in interaction with them either, as they leave St. Eustatius after one year. (Manager public sector, resident, 1.5 years, from abroad)

If there are 'norms and/or social capital' (U6) to keep agreements, transaction costs in reaching such agreements will be lower (Ostrom, 2009). If attributes of land are valued differently by various actors, ownership conflicts may arise. Ownership of attributes is often divided between two or more persons rather than being assigned to a single person, as is the case for tourism and roaming livestock. The rights to assets – or more specifically, to the asset attributes – are not fully delineated (Barzel, 1997) for St. Eustatius. This is especially true for grazing rights: there was regulation of these in the past, but nowadays restrictions are less clear. Due to the large decline in agricultural activity seen in recent decades (Freitas, Rojer, Nijhof, & Debrot, 2014), the need to limit or restrain livestock movement also declined to the point at which livestock herds now are allowed to roam without restraint.

Nooteboom (1999, p. 25) also emphasises the role and meaning of trust in governance. Trust lowers the cost of information and monitoring, because people who trust others are less secretive and supply information more readily. Small and homogeneous communities with strong personal bonding may be conducive to this, but trust also carries the risk of betrayal:

Personal and professional relations merge. It is a small population, everyone knows your business. That is one of the disadvantages of St. Eustatius. (Manager public sector, resident, 9 years, from abroad)

The one-to-one contact has a negative side as well. Gossip leads to backstabbing which leads to division, which leads to a lack of progress. If you are divided, you do not come together to build an industry. (Research consultant, resident, 6 years, from abroad)

Given a particular history, with sharp class and racial distinctions and where most locals have not been allowed a role in governance, social capital in Caribbean islands may be relatively scarce (McIntosh & Renard, 2010). From [Table 3](#), it follows that not all the issues score high on U6, implying that transaction costs could be relatively high. Interviewees also argue that trust in the island government can be compromised because of prioritizing self-interest:

I do not have much faith in the government. They do not have the best interest of St. Eustatius at heart, but rather their own best interest. (Employee public sector, resident, 3 years, from abroad)

It is doubtful whether the present more centralized control by Dutch authorities will do much to improve this: indications are that islanders are impatient with the involvement of outsiders:

The biggest threat is that we do not develop our own identity within the Netherlands. It needs to be based on an equal partnership. Now St. Eustatius is the child and the Netherlands is the parent. We have to act like equal partners. This means that the people of St. Eustatius have to stand up for themselves, be united to proof what we can do. (Research consultant, resident, 6 years, from abroad)

Table 3: Issues scored on second-order variables (low = not present, mod = present to a moderate degree, high = important). (For variables, see Ostrom, 2009).

Variables	1	2	3
	Tourism	Harvesting Conch	Grazing Goats
Collective-choice rules (GS6)	Mod	Mod	Low
Number of users (U1):			
• Citizens	Mod	Low?	Mod
• Tourists	11,000	Low	Low
• Entrepreneurs	10	1	-
Leadership/ Entrepreneurship (U5)	Low	High	Low
Norms/social capital (U6)	Low/Mod	High	Low
Knowledge of SES/mental models (U7)	Low/Mod	Low/Mod	Low/mod
Importance of resource (U8)	Moderate	Low	Moderate

Van de Kerkhof et al. (2014) conclude that perceived social capital in the form of friendly residents is also appreciated. About 77% of local residents use plants which grow locally (Cado van der Lely et al., 2014). Since the 1960s, the prohibition of free-roaming cattle was no longer enforced (DLG, 2011). Fenkl et al. (2014) found that residents nowadays are generally opposed to free-roaming livestock. However, it could not be deduced whether this reflects concern for the environment (erosion) or for traffic hazards. Citizens view the free-roaming animals as a nuisance but do not always recognize their negative environmental impact (Cado van der Lely et al., 2014). Increasing awareness or, in other words, changing norms is one of the options considered to deal with free-roaming livestock. However, alternatively newly implemented laws that prohibit free-roaming livestock could be strictly enforced and animals could be registered.

Tourism was highlighted as a socio-economic opportunity in St. Eustatius's strategic development plan (October 2010). When NuStar wanted to expand, the island government prioritized oil over tourism (in 2011). So priorities can change rapidly, making tourism development less predictable.

When users share 'common knowledge of the SES (U7)' they will perceive lower costs of organizing (Ostrom, 2009). If the users do not know the attributes of the tourism/leisure destination and how their activities affect those assets, they may inadvertently destroy the destination. In Tobago, positive learning relationships between the government and local stakeholders of a protected marine area (Buccoo Reef Marine Park) have been facilitated by governmental initiatives, conflict resolution, and a new institutional design (Adger, 2003). This experience increases the predictability of the system dynamics. However, preserving the amenities that attract tourists usually works better when local tourism entrepreneurs are part of efficient networks where knowledge on environmental conservation can spread; it is less effective where resorts are local and small-scale, such as in St. Eustatius (Yaw, 2005).

Lack of basic scientific knowledge keeps the discussion about the three cases at the level of opinions; "we had a commissioner of nature and agriculture who did not believe that goats were invasive to the island". This means that to achieve any significant progress, knowledge is essential to informed discussion and decision-making. There is also a lack of

assessment of stocks and levels of sustainable harvesting of conch (DLG, 2011). Lack of knowledge is detrimental to handling the livestock issue as well (DLG, 2011).

The final variable distinguished by Ostrom (2009) is 'Importance of resource to users (U8)'. This means that if users are largely dependent on the resource, they will consider its sustainability to be important. The resources have become more important due to population growth and increasing dependence on only one economic sector:

10 to 15 years ago we were only 2,000 people, now we are 3,500 people. We grew a lot, we need to take that into account. If we do not develop, we create a youth problem, a brain drain. After education the youth might not return, or when they return there is nothing to do. The economy will suffer from that. (Manager public sector, born in St. Eustatius, studied overseas)

We are not doing sufficient efforts to develop other economic pillars at St. Eustatius. Due to Nustar's storage facility, people tend not to look at other economic pillars. We have to anticipate that Nustar might be less lucrative in the future. We cannot depend on one major economic pillar. Other economic pillars could be tourism, agriculture or education. (Manager public sector, born in St. Eustatius, studied overseas)

Different groups of stakeholders attach different values to natural resources. People employed by Nustar are less dependent on the nature and landscape qualities of St. Eustatius, while stakeholders in the tourism sector are more concerned about degradation of natural quality. Interviewees mention how important tourism is for the island: some believe in it while others believe more in trade and agriculture:

There is a lot to do in tourism. People will need to embrace it, to want it. They have to be tourism-minded. We can preach all we want, the people need to want it. They have to make the distinction between giving service and being servant to. (Manager public sector, born in St. Eustatius, studied overseas)

The economic position of local fishers has declined over the past years (DLG, 2011). Fishing grounds have been restricted. Most fishers perceive marine reserves as taking away their fishing grounds from them. The quality of the near-shore fishing grounds has also declined dramatically (Debrot et al., 2014; van Kuijk, Graaf, Nagelkerke, Boman, & Debrot, 2015).

Discussion

Even though government and oil storage are perhaps the most important sources of employment and income on St. Eustatius (there are no recent detailed statistics), tourism is also a major income earner and moreover the one with most potential for expansion. In order to maintain that potential, and to conserve and enhance those ecosystem services that are important to the islanders themselves, sustainable management of crucial natural resources is crucial.

There are several constraints to achieving this, as demonstrated in the previous section. Some additional ones may be mentioned here. Firstly, coordination of environmental management between different islands would be useful, if only because it would permit islands to learn from each other's experience. CARICOM is an organization in which Caribbean states cooperate in a number of fields. The autonomous 'lands' such as Curaçao

participate in it, but the 'special municipalities' such as St. Eustatius do not. Any external expertise they need is not provided from within the Caribbean, but only from the distant Netherlands. Yet, the environmental problems of St. Eustatius are shared by many other Caribbean islands, large or small.

Complex socio-economic systems are managed by heterogeneous groups of users: citizens, entrepreneurs, NGOs, government bodies and tourists with different objectives ranging from hiking, nature exploration, or just relaxing and enjoying the place. Users of the ecosystem services include the local residents but also visitors from all over the world. Their involvement can be long-term or just for a few hours and they belong to different (social) networks. This socio-ecological system is complex and involves many stakeholders. Leisure is more oriented on a local scale level whereas tourism can involve citizens from the Caribbean region or further afield. It is difficult to disentangle investments for leisure and tourism which may lead to conflicts at different scale levels on who should invest to develop and maintain a combined tourism-leisure destination.

The degree of self-organization involving citizens, tourists and entrepreneurs is not identical for the different cases. From the interviews it follows that many stakeholders are concerned with the future of tourism on the island. Tourism largely depends on people from outside. Productivity potential for tourists is limited by the infrastructure that enables visits to the island:

More hotel accommodation, ferry service, airlifts, restaurants and shops are needed. Opportunities exist for mountain bike rental, electrical car rental. The transport system is a problem, especially the connection between lower and upper town. (Entrepreneur, long-term resident, over 20 years, from abroad).

Currently St. Eustatius has only 80 hotel rooms and airlift capacity is another issue. It is a problem to accommodate all our divers. (Entrepreneur, resident, 5 years, from abroad).

It is expected that mass tourism will not be possible because of the limited quality of beaches. Recreation by locals is limited by the number of inhabitants. The potential for gathering conch and grazing livestock is already approaching, or has exceeded, sustainability limits.

Conclusion: perspectives for natural resource management on St. Eustatius

In this paper, we analyse factors that affect self-organization of ecosystem services on a small island, which is a tourism and leisure destination. Ostrom's concept of socio-ecological systems was found to be a useful tool for this analysis in a small-island setting because it helps to identify relevant indicators, which guide the way to the questions to be asked. It also allows us to combine the answers to those questions into an overall understanding of the perspectives for natural-resource management.

The cases show that successful self-organization of ecosystem services is not an outcome achieved easily. The trade-offs between positive effects of investments in tourism facilities and negative effects through increased pressure on natural resources are important for the success of self-organising citizens. The heterogeneity of the users complicates governance of ecosystem services, because the distribution of costs and benefits of measures to improve the ecosystem services will differ among groups. Livestock owners are likely to suffer

increased costs if grazing livestock will be more restricted, while other stakeholders will benefit. Score analysis of the cases on the ten selected variables that are related to the likelihood of self-organization provide starting points for improvement.

- Information on the magnitude of ecosystem services (and their dependence on ecosystem conditions) will enhance understanding of the importance of ecosystem services management (U7). This is the only way to take the discussion from the level of uninformed debate to the realm of informed discussion and knowledge-based decision-making. While there has been a recent influx of new information on ecosystem characteristics, knowledge remains seriously lacking in many areas for the island. As long as that is the case, uninformed debate and decision making will likely continue to prevail. Therefore, to help the process of attaining sustainable management, it is important to identify and obtain the information most critical to decision-making.
- Although tourism is important for St. Eustatius's economy, many residents benefit from it only indirectly. Shared information on the relation between the value of ecosystem services and the spin-off of money spent by tourists might raise awareness of the importance of managing ecosystem services (variable U7 and U8). In the terminology used by Albuquerque and McElroy (1992), St. Eustatius is still an emerging tourist destination. This is also where its best potential for harmonious development lies. Mass tourism projects remain popular in the region, but are ill suited to St. Eustatius and will only help to further disenfranchise the local islanders. A better initiative would be to build upon St. Eustatius' strong archaeological and historical assets (e.g. restoring a small sugar mill as a tourist attraction), and aiming its promotional activities at ecotourists and other groups that appreciate unspoilt destinations. This will spread the benefits of tourism more widely.
- Measures to reduce the impact of grazing will have adverse effects for livestock farmers, which will decrease support for these measures within the community. Measures designed to minimize negative effects for large groups will be more successful (GS6 and U8). For instance, fencing goats out of the erosion-prone Lower Town area ([Figure 6](#)) will reduce the current rapid pace of erosion that is a threat to many residences and infrastructure at the top of the cliff on which Oranjestad is situated. However, in the long run a more comprehensive solution for the problem of soil erosion will be needed. Since this is a matter where the population as a whole will benefit but a minority will suffer, the obvious way forward is some form of compensation for that minority, while avoiding perverse incentives (e.g. people falsely claiming grazing rights, or reintroducing livestock after it has been removed). There are examples from other parts of the Caribbean of promising initiatives, such as buying out grazing rights in Curaçao (Debrot, 2015), or developing alternatives for livestock-keepers (Neijenhuis, Bos & Debrot, 2015). This is an area where self-governance should take the lead, but where government support is essential.
- A combination of measures beneficial to ecosystem services as well as to urgent local needs will stimulate the governance of ecosystem services. For instance, the construction of breakwaters along the shore of the Lower Town area can be used to

create snorkelling attractions for recreation and tourism, create habitat for fish as well as help protect coastal infrastructure and beaches (Figure 7). Measures that will visibly and simultaneously enhance ecosystem value for competing stakeholders (win-win) are preferable as they will likely enjoy broader stakeholder support.

Figure 7: A school of Blue Tangs swimming over the breakwater boulders on the southern side of St. Eustatius' City Pier. This artificial reef is a snorkelling attraction, protects the coast and provides habitat for harvestable fish. (Photo: Jessica Berkel).



For these recommendations to be realized, an informed discussion involving the stakeholders is critical. Firstly, the appropriate knowledge must be created; secondly, this knowledge needs to be communicated to the stakeholders in an effective way; and thirdly, a constructive and inclusive decision-making process must be set up and guided, and measures with demonstrable win-win attributes should be used to introduce stakeholders to the power of working together.

Acknowledgements

Authors thank Dolfi Debrot for constructive comments and his photo (Figure 6); and Jessica Berkel for her photo (Figure 7). Authors acknowledge funding by TripleP@sea KB-14-007.

References

- Adger, W.N. (2003). Social capital, collective action, and adaptation to climate change. *Economic Geography* 79(4), 387-404.
- Albuquerque, K. de, & McElroy, J.L. (1992). Caribbean small-island tourism styles and sustainable strategies. *Environmental Management* 16(5), 619-632.
- Barzel, Y. (1997). *Economic analysis of property rights*. 2nd edn. Cambridge: Cambridge University Press.
- Bass, S., & Dalal-Clayton, B. (1995). *Small island states and sustainable development: Strategic issues and experience*. London: IIED, Environmental Planning Issues, 8.
- Blaeijs de, A.T., Polman, N., & Reinhard, S. (2011). Economic governance to expand commercial wetlands: within- and cross-scale challenges. *Ecology & Society*, 16(1), 33.

- Blanco, E. (2010). A social-ecological approach to voluntary environmental initiatives: the case of nature-based tourism. *Policy Sciences* 44, 35-52.
- Briguglio, L. (1995). Small island developing states and their economic vulnerabilities. *World Development* 23(9), 1615-1632.
- Cado van der Lely, J.A., Warning, A.E., Schep, S.W., van Beukering, P., & Wolfs, E. (2014). *The total economic value of nature on St Eustatius*. Amsterdam, The Netherlands: Institute for Environmental Studies (IVM), Report R-14/12.
- CBS. (2014) *Toerisme in Caribisch Nederland 2012-2014*. Retrieved from <http://www.cbs.nl/nl-nl/menu/themas/vrije-tijd-cultuur/publicaties/artikelen/archief/2014/2014-4202-art.htm>
- Cornes, R., & Sandler, T. (1996). *The theory of externalities, public goods and club goods*. Cambridge: Cambridge University Press.
- Costanza, R., d'Arge, R., de Groot, R., Farber S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387, 253-260.
- Daily, G.C., Alexander, S., Ehrlich, P.R., Goulder, I., Lubchenco, J., Matson, P.A., Mooney, H.A., Postel, S., Schneider, S., Tilman, D., & Woodwell, G. (1997). Ecosystem services: benefits supplied to human societies by natural ecosystems. *Issues in Ecology* 2, 1-15.
- Davis, L.E., & North, D.C. (1971). *Institutional Change and American Economic Growth*. Cambridge: Cambridge University Press.
- Debrot, A.O., & Sybesma, J. (2000). The Dutch Antilles. In C. R. C. Sheppard (ed.), *Seas at the Millennium: An environmental evaluation*, Vol. I, pp. 595-614. Amsterdam: Elsevier.
- Debrot, A.O., Houtepen, E., Meesters, E.H, van Beek, I., Timmer, T., Boman, E., de Graaf, M., Dijkman, E., Hunting, E.R., & Ballantine, D.L. (2014). *Habitat diversity and bio-diversity of benthic seascapes of St. Eustatius*. IJmuiden: IMARES Report C078/14.
- Debrot, A.O., Hazenbosch, J.C.J., Piontek, S., Kraft, C., Van Belle, J., & Strijkstra, A. (2015). *Roaming livestock distribution, densities and population estimates for St. Eustatius, 2013*. IJmuiden: IMARES, report no. C088/15.
- Debrot, A.O. (2015). Working together smartly with nature: reforestation on the Dutch-Caribbean Leeward Islands (in Dutch) *Vakblad Natuur Bos Landschap* 2015 (April), 3-5.
- ECLAC (Economic Commission for Latin America & Caribbean). (1998). *National implementation of the SIDS/POA: A Caribbean perspective*. ECLAC, Trinidad.
- DLG. (2011). *Assessment of opportunities for sustainable agriculture and fisheries on St. Eustatius*. Utrecht, Report of mission 13-21 March 2011
- Fenkl, F., Laclé, F.A., Schep, S.W., van Beukering, P.J.H., Brander, L., & Wolfs, E. (2014). *The local cultural and recreational value of nature on St Eustatius*. The authors.
- Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social ecological systems. *Annual Review of Environmental Resources*, 30, 441-473.
- Freitas de, J., Rojer, A., Nijhof, B.S., & Debrot, A. (2014). *A landscape ecological vegetation map of Sint Eustatius (Lesser Antilles)*. Amsterdam: Amsterdam University Press.
- Hay, J.E., Suarez, A.G., Wong, P.P., Briguglio, L., & Ragoonaden, S. (2001). Small island states. In *IPCC: Climate Change 2001, IPCC Third Assessment Report*.
- ICAC (Independent Commission against Corruption, Australia). (2001). *Trouble in Paradise? Governance issues in small communities: Lord Howe Island*. Sydney.
- Jordan, E.J. (2014). Planning as a coping response to proposed tourism development. *Journal of Travel Research*, 20(1), 1-13.

- Kerkhof, S. van de, Schep, S.W., Beukering, P. van, Brander, L., & Wolfs, E. (2014). *The tourism value of nature on St Eustatius*. Amsterdam: Institute for Environmental Studies (IVM), Report R-14/07.
- Klok, C., Debrot, A.O., Meesters, H.W.G., Stapel, J., Slijkerman, D.M.E. (2011). Second opinion NuStar terminal expansion. IJmuiden: IMARES Wageningen UR. C148/11.
- Kuijk van, T., de Graaf, M., Nagelkerke, L., Boman, E., & Debrot, A.O. (2015). *Baseline assessment of the coral reef fish assemblages of St. Eustatius*. Ijmuiden, The Netherlands: IMARES Wageningen UR. C058/15.
- McIntosh, S., & Renard, Y. (2010). Placing the commons at the heart of community development: three case studies of community enterprise in Caribbean Islands. *International Journal of the Commons* 4(1), 160-182.
- Neijenhuis, F., Bos, B., & Debrot, D. (2015). Goatkeeping at Bonaire (in Dutch). Policy advice to the Public Body Bonaire and the Dutch Ministry of Economic Affairs. 21 July.
- Nooteboom, B. (1999). *Inter-firm alliances: Analysis and design*. London: Routledge.
- Ostrom, E., Burger, J., Field, C.B., Norgaard R.B., & Policansky, D. (1999). Revisiting the Commons: Local Lessons, Global Challenges. *Science* 284, 278-282.
- Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economics Perspectives* 13(3), 137-158.
- Ostrom, E. (2009). A general framework for analysing sustainability of social-ecological systems. *Science*, 325, 419-422.
- Paulay, G. (1994). Biodiversity on oceanic islands: origin and extinction. *American Zoologist* 34(1), 134-144.
- Polman, N.B.P., & Slangen, L.H.G. (2008). *Meervoudig Landgebruik in Winterswijk; Zelforganisatie in een aantrekkelijk landschap*. LEI Wageningen UR. Report 2008-039.
- Rojer, A. (1997). *Biological inventory of St. Eustatius*. Curaçao: Carmabi Foundation.
- Singh, A. (2008). *Governance in the Caribbean Sea: Implications for sustainable development*. Research Paper, United Nations: Nippon Foundation Fellowship Program.
- Tieskens, K.F., Schep, S.W., van Beukering, P.J.H., van Beek, I.J.M, Wolfs, E.M. (2014). *Mapping the economic value of ecosystems on St Eustatius*. Amsterdam: Institute for Environmental Studies (IVM), Report R-14/13.
- Velde van der, J., Hoogenboezem-Lanslots, K.M.A., Schenau, Y.M., van Leeuwen, R.J., Briene, M.F.M., de Freitas, J.A. (2010). *St. Eustatius, Strategic Development Plan*. Rotterdam, The Netherlands: Adviesbureau voor Ruimtelijk Beleid, Ontwikkeling en Inrichting B.V. (RBOI).
- Veldkamp, A., Polman, N., Reinhard, S., & Slingerland, M. (2011). From scaling to governance of the land system: bridging ecological and economic perspectives. *Ecology and Society* 16(1), 1.
- Vicente, V.P. (1996) Littoral ecological stability and economic development in small island states: the need for an equilibrium. *Coastal and Estuarine Studies*, 51, 266-283.
- VLIZ (2014). *Maritime boundaries geodatabase*, v.8. Retrieved from <http://www.marineregions.org/>
- Yaw, F. Jr. (2005). Cleaner technologies for sustainable tourism: Caribbean case studies. *Journal of Cleaner Production* 13, 117-134.