

Structure and financing of nature management costs in Caribbean Netherlands

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Summary

The Nature Policy Plan Caribbean Netherlands identifies the need to “Evaluate the financial instruments available for nature conservation in the Caribbean Netherlands and make recommendations aimed at guaranteeing a sustainable financial future” as one of its strategic actions. Three preceding studies investigated budget requirements and sustainable funding of nature (MINA 2000, Spergel 2005, Spergel 2014). These studies focused on the potential sources of income to achieve financial sustainability and led amongst others to the establishment of the trust fund.

The aim of this study by IMARES is to provide insight in the financial needs to carry out park management tasks based on quantifiable tasks. So, rather than the functional approach of earlier studies, which quantified budget needs based on staffing of the park management organizations, we here introduce a task-based approach to identify budget requirements. In this we used elements of the Netherlands cost standards for nature management (*'normenboek'*) to build an analytical calculation model which quantifies the annual budget requirements and human resources based on quantitative estimates of prices for material and labor. The budget requirements were then used to determine the financial gap between financial needs and income sources.

We incorporated the preliminary list of core management tasks recently developed by DCNA and the parks (Appendix A) and re-arranged the list in three levels (responsibilities-tasks-activities). Then we prioritized the four most important responsibilities to achieve the primary goal of nature conservation (infrastructure, education, monitoring, enforcement), merged similar tasks (e.g. monitoring and research) and included additional essential tasks. Furthermore we subdivided tasks in several tangible and quantifiable activities.

Critical monitoring tasks which we also included were a) habitat and species restoration and b) abiotic monitoring. Restoration from losses or damage to habitats and species is part of the primary goal of protecting nature against two major global threats to biodiversity: invasive species and habitat loss and destruction. Abiotic monitoring of factors that influence the abundance or distribution of key species and systems over time (e.g. rainfall, seawater temperature, salinity and water quality) was also included as it is essential to understand ecosystem trends for management purposes.

We further emphasize the importance of infrastructure and explicitly highlighted a number of infrastructure components which we consider essential: a) fences, grids and corrals to keep livestock out and animals in which are essential to protect sensitive habitats and structures; b) freshwater structures which are essential as water supply for flora and fauna; and c) routine maintenance and trimming of mangroves trees which is essential to keep the mangrove channels open.

Based on these prioritizations and extensive cost price information and estimates, the annual budget requirements of the core tasks are estimated at approx. USD 1,461,000 for STINAPA, USD 669,000 for STENAPA and also USD 669,000 for SCF (Table 3.1). The precise calculation of the budget requirements – specified at activity level - can be found in Appendix B.

Three financial gaps were identified: 1) the difference in annual budget requirements according to this study and according to an earlier DCNA assessment; 2) the financial gap in the DCNA trust fund required to start generating returns on investment; and 3) the difference between the annual budget requirements according to this study and the current income sources. With regards to the latter, STENAPA and SCF both have a structural financial deficit between financial needs and income resources amounting to USD 470,000 and 270,000, respectively. STINAPA only has a minor financial gap in 2015 amounting to USD 40,000 due to the financing of overdue mangrove maintenance.

We recommend parties to use the task-based calculation model as designed in this study for future management and fundraising purposes and to plan and justify the activities and budget requirements of the park management organizations. However, the price, cost and activity assumptions made in our calculation model should be validated by a third party and/or by the park management organizations e.g. through a workshop and should be regularly updated. We also recommend a sensitivity analysis of minimum and maximum amounts for different scenarios to be included in the calculation model. Furthermore the calculation model is generally applicable and can also be used and adapted to estimate the budget requirements of park management organizations on Curaçao and St. Maarten, and to calculate the appropriate level of the trust fund capital needed to ensure financial sustainability for nature management for the five participating islands.

1. Introduction

1.1 Background

The Dutch Government strives for effective and sustainable nature management in the Caribbean Netherlands. Marine and terrestrial nature is very important for the local economies of the Caribbean Netherlands islands, which depend greatly on tourism as the principal pillar of the economy, especially on Bonaire and Saba. Recent economic valuation studies on Bonaire, Saba and St. Eustatius estimated the Total Economic Value of the ecosystem services provided by the marine and terrestrial ecosystems at 28.4 million USD on Saba (Cado van der Lely et al 2014a), 25.2 million USD on St. Eustatius (Cado van der Lely et al 2014b) and 105 million USD on Bonaire (Cado van der Lely et al 2013). The tourism value of nature on the islands was estimated in the same study at 7.6 million USD on Saba (27% of the Total Economic Value) (Van de Kerkhof et al 2014a), 3 million USD (12%) on St. Eustatius (Van de Kerkhof et al 2014b) and 50 million USD (48%) on Bonaire (Schep et al 2012). These results highlight the importance of investing in sustainable nature management in Caribbean Netherlands.

The Dutch Government carries final responsibility for the protection of special areas and species, and for compliance with international and regional treaties and conventions which are ratified by the Kingdom of the Netherlands. This means that the Dutch Government promotes the implementation of relevant regional and international treaties, the responsibilities of which are laid down in the Nature Conservation Framework Act BES [*Wet grondslagen natuurbeheer en -bescherming BES*] and in the Nature Policy Plan Caribbean Netherlands (EZ 2013).

Nature Management in Caribbean Netherlands is organised differently than in the Netherlands. In the nineteen eighties, faced with serious financial constraints, the island governments decided to focus only on what they considered the most essential government tasks and divorced themselves of many "secondary" tasks. As part of that process, they delegated their responsibility for management of nature to the non-governmental nature conservation organizations (NGOs) existing on each island: 'Stichting Nationale Parken Bonaire' (STINAPA), St Eustatius National Parks (STENAPA) and Saba Conservation Foundation (SCF). The mandate of the park management organizations is written down in island legislation and management agreements and involves the establishment, implementation and enforcement of nature management plans.

The island governments give an annual financial contribution to the NGOs to assist them in performing these delegated tasks and responsibilities. The NGOs also generate their own sources of income, including user fees, grants, donations and souvenir sales. Facing structural deficits, large fluctuations in income due to global effects (e.g. decline in tourism after 9/11) and limits of scale to generate fees, the NGO's, after two decades of decentralization, decided to unite again and created the Dutch Caribbean Nature Alliance (DCNA). DCNA is a non-profit organization created specifically to unite the park organizations and represent them, provide them with a joint secretariat focused on assisting the park management organizations and other nature conservation organizations in the Dutch Caribbean through capacity building programs, exchange of expertise, improved governance, joint projects and outside fundraising. To address long term sustainable funding, DCNA became the holder of a trust fund, intended to eventually provide enough revenue to cover essential operational support for each of the park organizations. The target capital of this trust fund has not yet be reached however, and until such time DCNA can only provide emergency funding to bridge short periods in cases where the continued existence of a park organizations is acutely threatened.

The park management organizations continue to have capacity problems from time to time due to insufficient funding, which has consequences for their functioning as there is not enough staff and means to carry out the tasks and responsibilities.

The Nature Policy Plan Caribbean Netherlands identifies the need to “Evaluate the financial instruments available for nature conservation in the Caribbean Netherlands and make recommendations aimed at guaranteeing a sustainable financial future” as one of its strategic actions.

Three preceding studies investigated budget requirements and sustainable funding of nature: (1) in 2000 the section Environment and Nature [*Milieu en Natuur*] of the Dutch Antilles (MINA 2000) quantified financial needs for management of key nature areas in the Dutch Antilles; (2) in 2005 a feasibility study for a protected area trust fund (Spergel 2005) led to the establishment of a trust fund, managed by DCNA; and (3) in 2014 Spergel re-assessed the financial sustainability of nature parks in the Dutch Caribbean and recommended additional funding sources for park management organisations and the trust fund.

1.2 Assignment

To gain insight in the needs and requirements of nature management the Ministry of Economic Affairs requested IMARES to study the structure and financing of nature management costs in Caribbean Netherlands.

While the aforementioned studies of Spergel focus on the potential sources of income to achieve financial sustainability, the aim of this research is to provide an overview of the financial needs to carry out park management tasks (i.e. a task-based approach to determining costs). The results can be used in a gap analysis (Cost Benefit Analysis) to identify the financial gap between income and expenditures of nature management in Caribbean Netherlands. Our research includes the three islands of Caribbean Netherlands (Bonaire, Saba and St. Eustatius) while the other studies include all six islands of the former Dutch Antilles (including also Aruba, Curaçao and St. Maarten).

The chosen approach is to identify core management tasks of nature management in Caribbean Netherlands and matching annual budget requirements. The management tasks can be used as input for management agreements between park management organisations and local governments. Though focused on the Caribbean Netherlands, the outcomes of this study can also be applied to the other three islands, to the extent that their circumstances are similar.

1.3 Acknowledgements

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1.4 Reading suggestion

In chapter 2 the park management objectives are described in the context of nature conservation responsibilities, and specific management tasks are discussed. In chapter 3 the management tasks are quantified in annual budget requirements to operate a park management organisation. In chapter 4 the estimated budget requirements are compared to annual income and the funding gap is calculated to achieve financial sustainability of at least one terrestrial and one marine park on Bonaire, St. Eustatius and Saba.

2. Identification of management objectives, responsibilities and tasks

2.1 Methodology

Dutch and international legislation and treaties/conventions state high level management objectives. However, they usually lack the specification of concrete management tasks required to implement the objectives. In order to identify core management tasks in the context of overarching nature conservation responsibilities a number of documents were been assessed. Furthermore island governments and park management organisations on Saba, St. Eustatius and Bonaire and in the Netherlands have been consulted to identify specific management tasks and underlying activities.

High level objectives and general responsibilities of nature conservation described in international and regional treaties are addressed to put specific management tasks in the context of legal commitments of the Kingdom of the Netherlands (Table 2.1). Management objectives in national laws and nature policy and management agreements between park management organisations and island governments have been assessed to verify which tasks are already described and agreed on in a written document. Furthermore DCNA has been consulted, as they were in the process of agreeing with park management organisations on core management tasks simultaneously with this research.

2.2 Management objectives from international treaties/conventions

The Nature Conservation Framework Act BES [*Wet grondslagen natuurbeheer en -bescherming BES*] lists six international and regional treaties and conventions in Article 1 (i-n) (cf. Table 2.1). The Nature Policy Plan Caribbean Netherlands (EZ 2013) also refers to these, which are relevant for Caribbean Netherlands.

Regional cooperation is aimed at neighbouring countries. The islands participate in the Western Hemisphere Migratory Species Initiative (WHMSI), Regional Fisheries Management Organisations (RFMOs)), in particular the WECAFC, and the International Coral Reef Initiative (ICRI) (Nature Policy Plan Caribbean Netherlands 2013-2017). Additionally there are legally non-binding programmes/networks, such as the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), an integrated, regional capacity that ensures the recovery and sustainable management of depleted sea turtle populations: "*WIDECAST has been a partner organization for the Caribbean Environment Programme of UNEP (UNEP-CEP) since the early 1980s, and through the years it has demonstrated to be one of our most successful and effective alliances for the achievement of conservation and sustainable co-existence between Caribbean peoples and their marine resources.*" [1]

Table 2.1: Overview of international and regional treaties relevant for Caribbean Netherlands, and their main management objectives.

Name	Main objective
<p>Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) (1971)</p> <p>5 Ramsar sites on Bonaire: Slagbaai; Goto; Pekelmeer; Lac; Klein Bonaire</p>	<p>Legal framework for national action and international cooperation for the conservation and wise use of wetlands and their resources, covering the comprehensive protection of wetlands as important ecosystems for the maintenance of biodiversity.</p>
<p>Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (WCR) (Cartagena Convention) (1983)</p> <p>Supported by three technical Protocols: - Oil Spills (1983) - Land Based Sources of Marine Pollution (LBS) (1999) - Specially Protected Areas and Wildlife (SPAW) (1990)</p>	<p>Legal framework for cooperative regional and national actions for the protection and development of the marine environment in the Wider Caribbean Region (WCR).</p> <p>SPAW Protocol:</p> <ol style="list-style-type: none"> 1. Protection, preservation, management in a sustainable way of areas to safeguard their special value 2. Conservation of threatened or endangered species of flora and fauna and sustainable use of natural resources 3. Capacity development and coordination
<p>Convention on Biological Diversity (CBD) (1993)</p> <p>Resulting in: Ecologically or Biologically Significant Marine Areas (EBSAs) The Saba Bank is an EBSA to protect its biodiversity and prohibit anchoring. https://chm.cbd.int/#!/database/record?documentID=200096</p>	<p>Legal framework for international cooperation on:</p> <ol style="list-style-type: none"> 1. Conservation of biological diversity 2. Sustainable use of the components of biological diversity 3. Fair and equitable sharing of the benefits arising out of the utilization of genetic resources <p>EBSAs: Special areas in the ocean that serve important purposes, to support the healthy functioning of oceans and its many services.</p>
<p>Convention on the Conservation of Migratory Species of Wild Animals (CMS) (Bonn Convention)</p>	<p>Legal foundation for internationally coordinated conservation measures: Conservation of terrestrial, aquatic and avian migratory species throughout their range.</p>
<p>Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)</p>	<p>Agreements to ensure that international trade in specimens of wild animals and plants does not threaten their survival.</p>
<p>Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) (2001)</p>	<p>Legal framework for countries in the American Continent to take actions for the benefit of sea turtles: Implementation of harmonious measures between nations, multilateral coordination of conservation and protection actions, and oversight of the implementation of a regional agenda that will enable the recovery of sea turtles. Promotion of the protection, conservation and recovery of the populations of sea turtles and the habitats on which they depend.</p>
<p>Particularly Sensitive Sea Area (PSSA) of the International Maritime Organization (IMO)</p> <p>Since 2012, the Saba Bank is also a PSSA to regulate ship traffic around the Saba Bank.</p>	<p>Area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities. Particularly Sensitive Sea Area may be identified within a Special Area and vice versa.</p>

2.3 Division of management responsibilities between national and island authorities

The national government bears final responsibility for the protection of special areas and species according to the international treaties and conventions. The main legislation that provides for the division of roles and responsibilities between the Dutch national government and the islands' governing bodies is the Nature Conservation Framework Act BES [*Wet grondslagen natuurbeheer en -bescherming BES*]. Chapters 2 and 3 of this Act describe the tasks and responsibilities of the Dutch Minister of Economic Affairs and of the islands' governing bodies, respectively (cf. Table 2.2).

Table 2.2: Overview of the responsible national and island authorities and their management responsibilities, as written down in the Nature Conservation Framework Act BES [Wet grondslagen natuurbeheer en -bescherming BES].

Responsible authority	Responsibilities
Both, National Government and the islands' governing bodies	<ul style="list-style-type: none"> - Conservation and management of nature on the islands - Carry out obligations under the international agreements (Table 2.1)
Minister of Economic Affairs (Chapter 2 of the Nature Conservation Framework Act BES)	<ul style="list-style-type: none"> - sets up a nature policy plan every 5 years (including objectives, priorities, values, nature park list), prepared in close collaboration with the islands' executive council (article 2) - can designate nature parks according to the Ramsar Convention, SPAW Protocol and the CBD (article 2a). - can set up a Nature Management and Conservation Commission [<i>Commissie natuurbeheer en bescherming</i>] (article 3) - appoints a management authority to deal with CITES responsibilities (article 5) - appoints experts or institutions as scientific authority to deal with monitoring responsibilities for CITES and to advise around all issues related to nature management and protection (article 6) - direct responsibility for the management of areas that fall outside the island's jurisdiction but within the Kingdom's, i.e. the Exclusive Economic Zone (article 8d)
Nature Management and Conservation Commission [<i>Commissie natuurbeheer en bescherming</i>] (according to article 3)	<ul style="list-style-type: none"> - advise the Minister and the islands' executive council on measures relevant to the implementation of the Nature Conservation Framework Act BES.
Management authority [<i>beheersinstantie</i>] (article 5)	<ul style="list-style-type: none"> - carry out responsibilities for CITES - keep a register of species, persons etc for CITES
Executive council [<i>bestuurscollege</i>] (article 9)	<ul style="list-style-type: none"> - designate a nature plan [natuurplan] every 5 years, in line with the Nature Policy Plan, including action points with deadlines, and reports to the minister annually (article 9) - ensure that nature management within and outside of the designated protected areas are furnished with the resources and funds required (Natuurbeleidsplan CN) - ensure that the relevant policy, planning, legislation and enforcement are adequate to ensure proper protection of the islands' natural resources (Natuurbeleidsplan CN) - ensure compliance with the requirements of international treaties and conventions (Natuurbeleidsplan CN)
Island Council [<i>eilandsraad</i>] (articles 10-15)	<ul style="list-style-type: none"> - designate nature parks and communicates this to the Minister (article 10) - ensure management measures for the protection of species according to the IAC (article 11), CMS (article 12), SPAW protocol (article 13), CBD (article 14). - establish rules and regulations to implement these obligations for the island governments.
Designated officials or persons (article 16)	<ul style="list-style-type: none"> - patrol, investigate and enforce the law (articles 16-19) - officers with extraordinary police powers (<i>'Buitengewoon Opsporings Ambtenaar'</i>) are appointed by the Executive council [<i>bestuurscollege</i>] (article 16.2 and 18.2)
non-governmental park management organisations: - STINAPA - STENAPA - SCF	<ul style="list-style-type: none"> - responsible for the development and implementation of the management plans - enforcement authority - Mandates for these 3 island NGOs are anchored in regulations and/or management agreements (Management agreement STINAPA; Management agreement Saba Conservation Foundation (SCF))

Other legislation with relevance for nature management in Caribbean Netherlands are:

- Fisheries Act BES [Visserijwet BES] and Fisheries Decree BES [Visserijbesluit BES]
- Maritime Management Act BES [Wet Maritiem Beheer BES] (Ministry of Infrastructure and Environment)
- The Public Housing, Spatial Planning and Environmental Protection Act BES [Wet VROM-BES] (will come into force) (Ministry of Infrastructure and Environment).

The latter includes protection of environmental values.

The tasks of park management organizations differ on each island, depending amongst others on the particular mandate or agreement with the island government. Not all islands have agreements in writing.

There is a management agreement between STINAPA and the island government of Bonaire dating from 1991. The management agreement on Bonaire does not specify management tasks, it only delegates responsibility for the management of the marine park to STINAPA. It does not mention the terrestrial Washington Slagbaai protected area which was established as nature reserve in 1969. The other islands do not have a formal management agreement between the government and the park management organization. SCF is designated by island decree as manager of the Saba trail system, but only maintenance of the trails, collection of trail fees and the provision of information about the trail fee at hotels/lodging facilities are specified as tasks. STENAPA is appointed by island decree as manager of the marine park, specifying an agreement to delineate the tasks, but no agreement was ever drafted.

2.4 Key nature areas and essential components of protected area management

The '*Begroting en financieringsplan*' study of MINA in 2000 identified important nature areas for each island (cf. Table 2.3). The fundamental idea of the study was to ensure financial sustainability for at least one terrestrial and one marine area per island, as agreed in the nature platforms of 1996 and 1998 (MINA 2000). Table 2.3 presents an overview of these nature areas, and their legal status. Not all nature areas are legally protected, which has not changed since then, and only those parks with a legal status are officially declared national parks by the Dutch minister of Economic Affairs (EZ). Bonaire Marine Park, Saba Marine Park, Saba Bank, Statia Marine Park and Quil/Boven Park all have the formal status of National Park and have also been submitted and recognized as protected area of regional importance by the SPAW protocol (P. Hoetjes, pers. comm.).

The park management organizations have a "more or less well defined mandate" of the island government to manage the areas (MINA 2000). SCF has a formal agreement with EZ to manage the Saba Bank, because 80% of the 2,680 km² of the protected area lies outside the territorial waters in the Dutch Caribbean EEZ (P. Hoetjes, pers. comm.).

Table 2.3: Terrestrial and marine protected areas per island, including the legal protection status and mandate of the park management organization.

Island	Nature area	Mandate (MINA 2000)	Legal status (MINA 2000)
Bonaire	Terrestrial: Washington Slagbaai National Park (6000 ha) Marine: Entire coastline to 60m depth contour and Klein Bonaire (2700 ha)	Yes Yes	No, but in preparation Yes
St. Eustatius	Terrestrial: The Quill (220 ha)/Boven (320 ha) Marine: Entire coastline to 30m depth contour (2750 ha) Additional terrestrial area not listed in MINA (2000): Miriam C. Schmidt Botanical garden (not a protected area)	Yes Yes No	Yes Yes
Saba	Terrestrial: Saba National Land Park (43 ha) Marine: Entire coastline to 60m depth contour (1300 ha) Additional marine area not listed in MINA (2000): Saba Bank (2,680,00 ha protected area, of which 2,200,000 ha is to the 200 m isobath; and 1,850,000 ha is to the 50 m isobath)	Yes Yes Yes (with EZ)	No, but in preparation Yes

Currently the areas managed by STENAPA on St. Eustatius and SCF on Saba have expanded compared to the areas mentioned in the MINA study: The Miriam C. Schmidt Botanical Garden on St. Eustatius was established in 1998, after the island government donated the land. The Saba Bank Management Unit (SBMU), managed by SCF, was established in 2008, and has received its own funding resources from the Dutch Government since 2012, because the island government was not able to provide sustainable funding, 80% of the area lies outside Saban jurisdiction and responsibility for management falls directly towards the Dutch Government, and a fee system from fishermen licenses was considered not feasible (Lundvall 2008).

The 'Begroting en financieringsplan' study of MINA in 2000 identified management needs in terms of 'minimal management needs' and 'basic management needs'. The exact explanation of what these terms mean and which management tasks and activities are included was not part of the study. More recently, DCNA started – together with staff and board of the Park Management Organizations – to define the essential components of protected area management. They identified eight core management tasks: (1) Administration, (2) Field administration and maintenance, (3) Fundraising, (4) Information – education – outreach – stakeholders, (5) Research, (6) Monitoring, (7) Law enforcement, and (8) Advice. These eight task headers are further described and specified as basic and/or recommended tasks (cf. Appendix A).

2.5 Required park management activities

In order to produce a comprehensive list of all essential activities of a park management organization, we have further elaborated the list identified by DCNA and Park Management Organizations (Appendix A) and specified management activities, tasks and responsibilities. We grouped activities in two higher level categories: responsibilities and tasks. Responsibilities are defined as the core park management duties which are assigned to the park management organizations by the local government. Each responsibility is defined by a subset of tasks allocated to the park management organizations (Table 2.4).

Table 2.4: Identified core responsibilities of park management organization in this study, with a subset of core tasks per responsibility.

Black = basic activity identified by DCNA; Grey = recommended activity identified by DCNA; Red = recommended activity identified by DCNA but not IMARES; Green = recommended activity identified by IMARES

Resp. no.	Responsibilities	Task no.	Tasks	Acti- vity no.	Activity description
1	Infrastructure:		Installation, periodic inspection and maintenance of infrastructure within protected areas		
		1.1	Trails		
		1.2	Roads		
		1.3	Paved area		
		1.4	Buildings		
		1.5	Signage		
		1.6	Demarkation boundaries		
		1.7	Marine structures: moorings, piers, slipways		
		1.8	Freshwater structures: wells, dams, windmills, basins		
		1.9	Other terrestrial structures		
2	Public awareness and education:		Provide information about protected areas to visitors, outreach to the public , education for children and stakeholder engagement		
		2.1	Information to protected area users on area of special interest, conservation goals, rules and regulations		
		2.2	Outreach to the public at large and representation of nature conservation goals, activities and interests		
		2.3	Education programmes to youngsters		
		2.4	Stakeholder advice and involvement		
		2.5	Maintain media relations		
3	Monitoring and research:		Basic biodiversity and socio economic monitoring of the protected areas		
		3.1	Ecological monitoring on priority ecosystems/species based on management needs		
		3.2	Pest control of invasive species, roaming livestock and feral domestic animals		
		3.3	Habitat/species restoration		
		3.4	Abiotic monitoring		
		3.5	Socio economic monitoring		
		3.6	Research programmes		
4	Patrolling and enforcement:		Presence within protected areas to provide information and assistance and respond to user safety and law enforcement issues		
		4.1	Patrol protected areas		
		4.2	Enforce user fees, user permits, local laws and legal follow-up		
5	Equipment:		Provision and periodic inspection and maintenance of park equipment		
		5.1	Cars		
		5.2	Boats		
		5.3	Other equipment: field equipment, staff equipment, communication equipment, AV equipment, office equipment		
6	Finance and administration:		Financial management and administration of the park management organization		
		6.1	Accounting		
		6.2	Administration		
		6.3	Fundraising		
7	Management:		Overall management of the park management organization		
		7.1	Planning		
		7.2	Coordination		
		7.3	Staff management		
		7.4	Fundraising		
		7.5	Reporting		

We identified seven main responsibilities: (1) Infrastructure, (2) Information and education, (3) Monitoring and research, (4) Patrolling and enforcement, (5) Equipment, (6) Administration, and (7) Management, and a variety of tasks per responsibility (cf. Table 2.4). The tasks listed in black in Table 2.4 were identified by DCNA, those listed in green have been identified by IMARES in the course of our study.

To fulfill each task one or more specific activities need to be performed. These are specified further below in Table 2.5. For each activity the standard costs can be calculated based on the inputs (staff, equipment and material) required for each activity. This is the basis to calculate annual budget requirements, which is done in chapter 3.

Before listing the individual activities per task (cf. Table 2.5 on pg. 24), we first elaborate on the seven identified responsibilities and explain their importance. We provide a short description of the objective, results and output for each task listed in Table 2.4 above.

2.5.1 Infrastructure

Trails and roads

Trails and roads are needed for almost all core functions of the park. Roads need to be kept open to allow dependable vehicular access for the purpose of maintenance of all other infrastructure, enforcement, invasive species control, and visitor safety.

For the visiting public, roads are the principal form of vehicle access, and trails are generally more intended for visitor access to interesting areas and viewpoints.

Useful and indispensable on the one hand, roads and trails represent damage to nature on the other hand. They channel disturbance and therefore have to be carefully chosen, allowing access to beautiful areas and features of the park, but at the same time avoiding damage to ecologically sensitive areas. Roads and trails further need to be safe and should be designed to limit erosion. Hesselbarth and Vachowski (2000) provide guidelines on trail construction to limit erosion (Fig. 2.1). Also roads passing through rainwater conduits like gullies or streams are prone to erosion. Erosion control entails special embankment, paving of sensitive areas and construction of labadó's (spillways). Routine maintenance of roads and trails mostly takes place after the rainy season when vegetative growth and erosional damage are typically highest.



Fig. 2.1: Costly consequences of improper nature trail placement and maintenance in the Christoffel park Curacao (photo: A. Debrot).

Paved areas

Parks typically comprise a variety of paved areas for various purposes such as camping and parking. These are often located close to key attractions open to the public. These need to be kept safe and accessible.

Buildings

Buildings are a key form of infrastructure of most parks. They house offices, equipment and visitor facilities like toilets and displays. Buildings in park areas also often include historic structures which require special maintenance. This may entail restrictions on the allowed materials and on maintenance procedures, such that the historic values are not lost.

Signage

Signage provides key information for visitors. Signage instructs about park rules and how to safely find your way around. Signage also teaches about park values, so that visitors understand what they are seeing, and why they need to follow park rules. Signage needs to be unobtrusive, yet readily seen and unambiguous. To function properly signage needs to be checked and kept up regularly.

Demarcation boundaries

Demarcation boundaries indicate boundaries of special areas. Visitors are intended to remain either within or outside of these boundaries, and beyond often different rules apply.

For terrestrial park areas demarcation boundaries will often be fences (to keep livestock out or animals in), such as perimeter fences, or fences and signage to protect the public in areas of potential danger (such as waves or steep precipices). In the marine environment demarcation boundaries will typically be navigation buoys or zoning markers for marine or fish reserves.

Marine structures

Marine structures of importance are buoys for anchoring vessels, and slipways and piers for the safe boarding of vessels. Buoys are crucial to maintain for diver and boater safety. Failure of anchor lines can put lives in danger and must therefore be inspected, maintained, and replaced according to set schedules.

Freshwater structures

Freshwater structures include wells, dams, windmills, springs. These either provide important freshwater for fauna and flora or involve historic sites. Each type of structure requires a different form of maintenance depending on its function and degree of historic importance. For instance, a modern pos di pia (foot well) can be restored with a bulldozer, but an ancient pos di pia lined with stones by prehistoric Indians should not be restored with a bulldozer. Springs are also sensitive structures and should be maintained by hand and not with any kind of heavy machinery.

Wells will require regular maintenance of the boká (well rim) and periodic dredging. All need to take place by hand. Structures of historic significance, such as certain stone or wooden fences, should only be repaired under expert guidance (Fig. 2.2). In many cases such as historic ruins of buildings or walls, repairs should not be allowed. At most, site stabilization might be appropriate. In all cases any structural modification or changes to historic structures should be done under expert guidance.



Fig 2.2: Example of a structure of cultural and historic significance inappropriate for restoration. The goal in this case is stabilization and only under expert guidance (photo: A. Debrot).

Other terrestrial structures

Labadó, and livestock grids are other structures of importance to park management. The first are spillways to allow water to pass low-lying parts of roads without causing erosion. The second are structures to prevent livestock from passing through a fence that needs to be kept open to allow vehicular access.

2.5.2 Public awareness and education

Information to protected area users on areas/species of special interest, conservation goals, rules and regulations

A protected area that is open to visitors needs to inform the visitors, reach out, raise awareness and teach about why this area is protected and explain the specific rules that apply to the use of this area.

Information that needs to be developed and provided to the public should include appropriate signage at the entrances and at sites of special interest; it also includes the provision of entrance tickets and of flyers/posters/leaflets/brochures/apps to inform users of park goals, rules and regulations and the biodiversity protected within the park.

Outreach to the public at large and representation of nature conservation goals, activities and interests

The main motivation for outreach to the public is to raise public awareness about nature conservation objectives, its usefulness, values, and opportunities. More awareness and better understanding of the public about why conservation is important can provide greater legitimacy, enhance compliance, and reduce the intensity of conflict (Christie et al. 2009; Christie 2011; Young et al. 2013).

The St. Eustatius National Marine Park Management Plan 2007, for example, includes this aspect, suggesting to promote sustainable development by raising stakeholders' awareness, targeting them "with outreach materials highlighting the importance of the environment for St Eustatius" (MacRae and Esteban 2007). All existing island management plans (MacRae and Esteban 2007, 2009; Lundvall 2008; De Meyer and MacRae 2006, Simal 2005) list concrete outreach activities (or "Environmental education" in Simal 2005), such as: communication strategy, visitor centre, interpretation (e.g. guided hikes), print work (e.g. leaflets), media relations, education programme, website, newsletters, representation.

DCNA and park management organizations identified "international representation" as an additional, recommended task (cf. Appendix A). In contrast, we argue that international outreach and representation is primarily a responsibility for DCNA, and park managers should not be burdened with this additional task (park managers who are part of the board of DCNA can of course be asked to give presentations and join meetings or debates). Participation in (sub)regional fora/conferences/workshops (e.g. GCFI, CampPAM, Sister Sanctuaries Network) is a legitimate and important part of nature management when joint, larger scale programs require cooperation in regional projects (e.g. coral reef and marine mammal monitoring, sea turtle and shark tagging projects).

Education programmes to youngsters

Education programmes to local youngsters comprise regular in school and out of school programmes, focused on the protected area. For in school programmes, school material needs to be developed. Out of school activities may include snorkel classes, sea scouts, junior ranger club, guided trail tours etc.

We recommend that advanced trainings should only be carried out if the programme generates income, e.g. academic school programmes and paid volunteer programs. These education programmes are an opportunity to use as fundraising tool, however should only be carried out if the costs do not exceed the income generated, after the inevitable initial investment in developing the programs.

Stakeholder advice and involvement

Stakeholder involvement in the management of nature and natural resources has been called “the cornerstone of democracy” (Arnstein 1969, p. 216). Many have highlighted and explained the increasing importance of stakeholder engagement and participatory processes in nature/natural resources management and governance in order to provide greater legitimacy, enhance compliance, and reduce the intensity of conflict (Christie et al. 2009; Christie 2011; Young et al. 2013). In addition, Röckmann et al. (2015) emphasize that it is crucial to be aware of the context in which management takes place, as stakeholder involvement is no panacea. It comes with commitments to salient, legitimate and credible management, and it requires time, transparency and trust (Röckmann et al. 2012). A critical question is: Who are the relevant stakeholders to get to the table? (Reed et al. 2009). We suggest to get involved with local community and businesses, decision makers, civil servants, governments, researchers and research institutes. The St. Eustatius National Marine Park Management Plan 2007 explicitly mentions to “[m]anage conflict between fishermen and other users” as a key issue (MacRae and Esteban 2007). It is important to design participatory processes well, because if handled badly, they can result in counterproductive negative consequences (e.g. erosion of trust between partners and end of cooperation (Reed et al. 2009).

According to the existing island management plans, stakeholder advice and involvement is happening already, because all plans acknowledge the “cooperation and enthusiastic support of a number of individuals and organisations” in their development.

Maintain media relations

Media contacts are crucial to achieve successful outreach. Such contacts consist of making press releases and giving interviews, if required also in combination with a field trip.

Developing a regional and international media strategy, although it is a necessary basis for external fundraising, is specialized work for which park management organisations are not equipped. It is one of the reasons the park organizations formed DCNA. This task has been deferred to DCNA by the parks.

2.5.3 Monitoring and research

The main objective of nature management is of course conservation and protection of nature and biodiversity. Monitoring and research needed to evaluate the effectiveness of management in achieving its objectives are considered a core task. Monitoring and research that do not directly contribute to the management, outreach, or stakeholder involvement objectives however, or require specialist expertise should be left to external organisations that can nevertheless, be facilitated to carry out such work.

This concept is also highlighted by the STENAPA management plan of 2009. Management goal number 2 is: “Conserve, through practical conservation and active management”, by addressing “the full spectrum of human values to make the Protected Areas a success.” “This goal will ensure that STENAPA does not attach too much importance to the scientific and technical aspects of managing the natural environment, at the expense of the human, cultural, and spiritual aspects.” (MacRae et al. 2009). This plan further explains that “with few staff STENAPA can’t do everything” (MacRae et al. 2009, p.97).

At the same time, the plan lists activities that are in contrast to this conception, and they should be carefully reviewed (see discussion).

Ecological monitoring

Ecological monitoring is valuable and important for management evaluation and adaptation. However, tropical ecosystems are known to be very diverse and it can be very easy to be tempted to monitor everything. Ecological monitoring should be cautiously limited to key habitats and species as closely linked to quantifiable management objectives (EZ 2010).

Monitoring of permanent reference habitats and species is essential as part of an ecological assessment framework, which offers guidance during licensing of planned activities on biodiversity, water quality and the physical structures of coastal ecosystems. The principal functions of such an ecological assessment and monitoring plan are to: establish baseline data on the ecosystem state; establish the status and patterns in ecosystem components e.g. corals, fish, seagrass, mangroves; identify undesirable conditions; measure the impact of an action and evaluate the effectiveness of management strategies (Becking and Slijkerman, 2012).

Given the priorities for nature protection for park management, monitoring usually forms a small part of allocated funding and personnel time in park management organizations (NPS 2008). Under normal conditions, park organizations rely largely on outside effort for monitoring and should only provide essential facilitation for monitoring and research teams (e.g. Casanovas et al. 2014, IFG 2014a, IFG 2014b, NPS 2009). Preferably monitoring should be limited to:

- the most ecologically important indicators;
- stable indicators that do not fluctuate widely;
- easy to measure in practice;
- indicators coupled to other indicators, both biotic and abiotic.



Fig. 2.3: Pieriid butterflies sitting on a pile of dung in St. Eustatius. Colourful and interesting but highly variable in abundance and not directly linked to quantifiable management objectives. Butterflies are a low priority for park management monitoring (photo: A. Debrot).

In most parks around the world monitoring activity only uses up a small part of the total park budget, at most only a few percent of total annual budget expenditures are dedicated to monitoring (and research) (Casanovas et al 2014, IFG 2014a, IFG, 2014b, NPS 2008, 2009, SLO 2014).

Abiotic monitoring

Trends in abundance or distribution of key species or systems over time may be caused by a number of factors. To be able to understand why changes in fauna and flora are or are not taking place it is essential to do a minimum of monitoring of abiotic factors that influence species abundance and distribution. For instance, a key factor in terrestrial ecology is rainfall. Collecting a time series of rainfall data for use by scientists and against which to interpret changes in fauna or flora is critical, but often lost sight of. Several of such parameters may be provided by the island meteorological service, but supplemental data collection on rainfall, seawater temperature, current velocity and direction, or salinity and depth in salinas, or freshwater quality and availability at key sites can greatly enhance ecosystem understanding for management purposes.

Socioeconomic monitoring

Basic information and statistics on park visitors and opinions or observations are key to adaptive management. This kind of information provides key information on how visitors experience different aspects of the park, ranging from road quality, to staff hospitality, special needs or desires, which attractions or dive sites are most visited and which least, etc. Dangerous incidents and accidents should also be monitored in order to be able to prevent repetition.

Collection of basic socioeconomic indicators (e.g. number of jobs and income created, related directly or indirectly to the existence of the park) are vital to management evaluation and adaptation and are a basic management monitoring need.

Research programmes

Fundamental and applied scientific research involves specialists. As parks will typically possess a few hundred or thousand species to investigate, park management often lack the time and expertise to carry out research, or can get distracted from core nature management tasks. Instead, park management can attract visiting scientists or volunteers to carry out research tasks. In fact, visiting scientists' research should be seen as a potential income source for management, rather than a cost. Many management and research institutes throughout the region (i.e. CNSI, Carmabi, Bimini Shark Lab) actually use the willingness of visiting scientists to pay for support as the basis of their business model. Hein et al. (2013) stress the need for biodiversity conservation to base park management on a broader series of funding sources, and the development of knowledge-tourism is clearly an opportunity for small islands seeking to diversify their tourism product.



Fig 2.4: Winter field research and monitoring course for college students, today part of the conservation business model throughout the region (photo: B. Fouke).

Control of invasive species, roaming livestock and feral domestic animals

Apart from climate change, invasive species arguably constitute about the greatest threat to biodiversity in the Caribbean Netherlands (van Buurt and Debrot 2011, Debrot et al. 2011, van der Burg et al. 2012, van Buurt and Debrot 2012). Premier among these are introduced feral grazers, like goats and donkeys, introduced predators, particularly cats on Saba and Bonaire, and various species of plants which tend to compete strongly with native species and may permanently alter ecosystems.

A strategy has been developed together with the park organizations on the various islands (Smith et al. 2014), but has yet to be incorporated into park action plans.



Fig 2.5: The single greatest terrestrial ecological threat of the Dutch Caribbean are roaming goats. Stripping a key food producing tree of its regeneration potential (Photo: P. Bertuol).

Habitat and species restoration

Habitat and species restoration are the premier goal of nature conservation, which involves besides protection and preservation also restoration from losses or damage to habitats and species. Unfortunately these critical tasks are often lost out of sight and presently only play a minor role in day to day management. These critical tasks therefore, need to be consciously apportioned time and budget in the management program. As yet there are very few species action plans for the Caribbean Netherlands. The few habitat/species restoration plans which have been written are those for sea turtles (Sybesma 1992, cetaceans (Debrot et al. 2011), sharks (Van Beek et al. 2014), and the Lesser Antillean Iguana of St. Eustatius (Debrot et al. 2013). Reforestation has been done and shows promising results in several locations of the Dutch Caribbean (e.g. Debrot 2013) but, with the exception of the Klein Bonaire reforestation project, so far have not been integrated into actual park management in the Caribbean Netherlands.



Fig 2.6: Endangered terns responding dramatically to nesting habitat restoration in the Cargill salt complex of southern Bonaire (Photo: P. Bertuol).

2.5.4 Patrolling and enforcement

Patrolling is a labor-, vehicle- and often fuel-intensive activity. It does not only serve to control and enforce, but may serve multiple functions such as to inform, instruct, and monitor visitor use of protected areas (G. Pastink, pers. comm.). Patrolling is typically seen as a key necessity for enforcement in the Dutch Caribbean, but examples worldwide show variations and changes in how actual enforcement is organized. In one extreme, such as the Netherlands, the game warden today is more a “nature host”, while in many third-world countries, game wardens are more like well-armed para-military forces that face increasingly high risks of attacks by poachers (NOS, 2013). In the Dutch Caribbean many of the protected areas are in the marine environment where there is open access, where active use of resources by both fishermen, divers and in some cases international shipping tend to conflict with each other, and where strict control of harmful fishing methods (spearfishing, gillnets) and no-take zones is necessary. In such situations active surveillance/presence and enforcement can be necessary. The terrestrial protected areas often contain vulnerable species such as orchids and ferns and bromeliads that are in high demand with collectors, which also require active enforcement of protection. The Dutch nature management foundation ‘*Natuurmonumenten*’ confirmed that patrolling is a necessary task in all its managed nature areas (J. Jilleba, pers. comm.). In general, only employees and volunteers who have been trained for patrolling duties are assigned patrolling services (e.g. patrolling shifts of several hours).

The need for patrolling depends on the particular area and time. For example, patrolling can be more important in the weekend than during the week. In the Dutch nature areas, patrolling is certainly not a 24/7 task.

With economic improvements and changes in culture and attitudes towards nature, animal welfare, and hunting, the general public has developed an increased awareness for conservation. The extent of illegal, or potentially illegal, activities harmful to nature by the visiting public has declined, in the Netherlands as well as in the Dutch Caribbean (EZ, 2014). Moreover, due to the wide availability of cellular telephones, the visiting public is gradually participating much more actively in park activities such as monitoring and safety, serving effectively as the eyes and ears of an early warning system for enforcement.

All existing island management plans (MacRae and Esteban 2007, 2009; Lundvall 2008; De Meyer and MacRae 2006, Simal 2005) highlight the importance and need for patrolling and surveillance on a regular basis.

2.5.5 Equipment

Vehicles are the essential equipment for park management organizations to carry out their core management tasks, such as patrolling and inspection of infrastructure within the protected areas. The terrestrial and marine areas mostly require heavy duty vehicles, such as 4WD cars and boats. Other equipment includes field equipment for installation and maintenance of infrastructure, dive equipment, field communication equipment by VHF, audio visual equipment for awareness raising, education and monitoring purposes. Staff uniforms and office equipment should not be forgotten either.

2.5.6 Finance and administration

An essential responsibility of park management organizations is to be accountable to the board, island government and other donors. This involves keeping an accurate bookkeeping of income and expenditure, preparing the annual financial statement and have audited annual accounts. DCNA and park management organizations identified "Accurate cash-based recording of income and expenditure" as a basic management task, while "Accrual based accounting including deferred income for projects" and "production of an annual financial statement" are considered a recommended management task. Both of the latter are essential to get an approved auditor's report.

Other administration responsibilities are the office administration, stock administration and personnel administration, as well as accurate collection and administration of all fundraising sources.

2.5.7 Management

Sound management of the protected area is another essential responsibility. This involves keeping an up to date management plan of the protected areas; planning the annual activities and determining the budget requirements for that particular year; coordinating the implementation of the annual action plan, including the day-to-day activities; and reporting the achievements in periodic and annual reports to the board, island government and other donors.

A core management task of protected areas is identifying and describing the significance and condition of natural values within the park. As an example, the key elements of the adaptive management framework of The Quill management plan 2009 (MacRae et al. 2009) are:

1. Identifying and describing the significance and condition of natural values within the parks
2. Identifying and describing the threats and issues facing the natural values
3. Assessing which threats pose the greatest risk to the natural values
4. Developing and prioritizing management objectives
5. Developing and implementing management actions to address threats
6. Measuring the success of those management actions

7. Adapting management approaches based on the outcome of measured actions.

Table 2.5: The list of core activities identified to carry out tasks and responsibilities of park management organizations. The tasks listed in black, grey or red were identified by DCNA (black refers to basic tasks, grey to recommended tasks and red to tasks IMARES does not recommend as core task), those listed in green have been identified by IMARES in the course of our study.

Black = basic activity identified by DCNA; Grey = recommended activity identified by DCNA; Red = recommended activity identified by DCNA but not IMARES; Green = recommended activity identified by IMARES

Resp. no.	Responsibilities	Task no.	Tasks	Acti- vity no.	Activity description
1	Infrastructure:				Installation, periodic inspection and maintenance of infrastructure within protected areas
		1.1	Trails		
				1.1.1	Trail placement
				1.1.2	Big trail maintenance: erosion control/clear stakes/create steps
				1.1.3	Small trail maintenance: trim vegetation (woodland)
				1.1.4	Small trail maintenance: trim vegetation (shrub)
				1.1.5	Mangrove channel placement: open channels
				1.1.6	Mangrove channel big maintenance: enlarge channel width
				1.1.7	Mangrove channel small maintenance: trim trees
		1.2	Roads		
				1.2.1	Dirt road placement/big maintenance: grading and scraping
				1.2.2	Dirt road annual maintenance: scraping
				1.2.3	Dirt road small maintenance: trim scrub
				1.2.4	Paved road placement
				1.2.5	Paved road extension big maintenance
				1.2.6	Paved road big maintenance
				1.2.7	Paved road maintenance: remove rocks/repair
		1.3	Paved area		
				1.3.1	Porch construction/maintenance
				1.3.2	Boardwalk construction/maintenance
				1.3.3	Parking lot construction/maintenance
		1.4	Buildings		
				1.4.1	Visitor center/museum construction/big maintenance
				1.4.2	Office construction/ big maintenance
				1.4.3	Storage construction/big maintenance
				1.4.4	Public bathroom construction/ big maintenance
				1.4.5	Other buildings construction/ big maintenance
				1.4.6	Cleaning/interior maintenance of buildings
		1.5	Signage		
				1.5.1	Signage: information boards at points of interest
				1.5.2	Signage: signposts at points of interest and intersections
		1.6	Demarkation boundaries		
				1.6.1	Fences
				1.6.2	Reserve boundaries/navigation buoys
		1.7	Marine structures: moorings, piers, slipways		
				1.7.1	Mooring (re)placement buoy and lines
				1.7.2	Mooring maintenance: clean/paint/repair
				1.7.3	Mooring placement: Drill anchor points for moorings
				1.7.4	Pier maintenance: rental
				1.7.5	Slipway maintenance: government financed
		1.8	Freshwater structures: wells, dams, windmills, basins		
				1.8.1	Wide well placement/big maintenance: dig by hand
				1.8.2	Wide well small maintenance: trim bushes
				1.8.3	Deep well placement: no maintenance needed
				1.8.4	Deep well small maintenance: trim bushes
				1.8.5	Historic pos di pia placement/big maintenance: dig by hand
				1.8.6	Modern pos di pia placement/big maintenance: dig with bulldozer
				1.8.7	Pos di pia: trim bushes
				1.8.8	Dams: restore with bulldozer
				1.8.9	Windmill placement/big maintenance
		1.9	Other terrestrial structures		
				1.9.1	Labado placement (verhard stuk weg)
				1.9.2	Labado maintenance: control/remove rocks/repair
				1.9.3	Livestock corrals
				1.9.4	Livestock grids

Table 2.5 (continued)

2	Public awareness and education: Provide information about protected areas to visitors, outreach to the public , education for children and stakeholder engagement
	2.1 Information to protected area users on area of special interest, conservation goals, rules and regulations
	2.1.1 Develop user information brochures (diving, yachting, hiking, nature, history) flyers, posters
	2.1.2 Provide user information brochures
	2.1.3 Provide information signage: outdoor visitor display
	2.1.4 Provide information signage: indoor visitor display
	2.1.5 Park entrance ticket purchase and information
	2.1.6 Provide guided tours (Saba, Statia)
	2.1.7 Develop new thematic trails (i.e. snorkel trail, birding trail) --> follow-up activities infrastructure 1.1.1, 1.3.1, 1.3.2
	2.2 Outreach to the public at large and representation of nature conservation goals, activities and interests
	2.2.1 Maintain website
	2.2.2 Maintain social media posts
	2.2.3 Distribute newsletters
	2.2.4 Give local presentation
	2.2.5 International representation (presentations, committees, debates) --> DCNA responsibility
	2.3 Education programmes to youngsters
	2.3.1 In school programme for children (at least once in each school year, Saba monthly)
	2.3.2 Out of school programmes for children (snorkel club, sea scouts, junior rangers, guided trail tours)
	2.3.3 Advanced trainings (dive certification, activity camp, junior ranger, vocational training) --> only income generated
	2.3.4 Academic school programmes --> only as fundraising tool if the income it generates exceeds the costs
	2.4 Stakeholder advice and involvement
	2.4.1 Organise community/local business meetings
	see 3.6.1 2.4.2 Engage researchers/research institutes to set research priorities
	2.4.3 Engage decision makers in nature conservation, provide advice to civil servants and governments, participate in decision making
	2.4.4 Facilitate stakeholder participation in protected area management --> sufficiently included in the above
	2.5 Maintain media relations
	2.5.1 Make press releases
	2.5.2 Give interviews (combined with a fieldtrip if required)
	2.5.3 Develop a regional and international media strategy --> DCNA responsibility
3	Monitoring and research: Basic biodiversity and socio economic monitoring of the protected areas
	3.1 Ecological monitoring on priority ecosystems/species based on management needs
	3.1.1 Terrestrial monitoring/research support
	3.1.2 Terrestrial monitoring/research support
	3.1.3 Marine monitoring/research support: reef transects (benthos+fish)
	3.1.4 Marine monitoring/research support: reef transects (benthos+fish)
	3.1.5 Saba Bank monitoring/research support: fisheries monitoring (port+onboard)
	3.2 Pest control of invasive species, roaming livestock and feral domestic animals
	3.2.1 Terrestrial invasive species: regular removal corallita, rubbervine, goats, feral cats, etc.
	3.2.2 Terrestrial invasive species: regular removal of feral animals
	3.2.3 Marine invasive species: regular removal lionfish, etc.
	3.3 Habitat/species restoration
	3.3.1 Terrestrial habitat restoration: National Park/Lac reforestation, Klein Bonaire restoration, etc.
	3.3.2 Marine habitat restoration: reef cleanup, coral restoration, goat trap removal etc.
	3.3.3 Terrestrial species management plan implementation: statia morning glory, iguanas, birds etc.
	3.3.4 Marine species management plan implementation: sea turtles, sharks, etc.
	3.3.5 Saba Bank habitat restoration: ghost trap detection and removal (combined with patrolling)
	3.4 Abiotic monitoring
	3.4.1 Weather station monitoring (temp, rain, wind) and distribution to third parties for analysis
	3.4.2 Water quality monitoring (temp, salinity, pH, O ₂ , nutrients)
	3.5 Socio economic monitoring
	3.5.1 Collect resource use statistics, visitor use, local use, user activities
	3.5.2 Analyse socio economic data (valuation, user preference, carrying capacity) --> submit data to research institutions
	3.6 Research programmes
	see 2.4.2 3.6.1 Set research agenda and identify research institutions to address management needs and potential threats in
	3.6.2 Facilitate selected research programmes ie provide logistical support --> ask financial contribution
	3.6.3 Participate, initiate or implement research programmes
4	Patrolling and enforcement: Presence within protected areas to provide information and assistance and respond to user safety and law enforcement issues
	4.1 Patrol protected areas
	4.1.1 Terrestrial patrolling (besides field presence when conducting field work)
	4.1.2 Marine patrolling
	4.1.3 Keep record of patrols: included in 4.1.1
	4.1.4 Review safety protocols (missing diver, trail search and rescue, communication procedures)
	4.2 Enforce user fees, user permits, local laws and legal follow-up
	4.2.1 Patrol to check user fees (or check the user fee collection system)
	4.2.2 Provide information to users (visitors, fishermen, etc) on park rules and regulations, permits, island policy and
	4.2.3 Report and intercede with illegal activities (provide user information, issue warnings, notify appropriate agencies)
	4.2.4 Law enforcement activity requiring 'Buitengewoon agent van politie authority'
	4.2.5 Legal enforcement such as filing reports of incidents, writing up prosecutions, issuing summons and on the spot
	4.2.6 Assist in the issue of permits, exemptions and enforcement

Table 2.5 (continued)

5 Equipment:	Provision and periodic inspection and maintenance of park equipment
	5.1 Cars
	5.1.1 Purchase Toyota 4WD
	5.1.2 Purchase Toyota 2WD
	5.1.3 Purchase golfcart
	5.1.4 Major servicing of vehicles
	5.1.5 Periodic servicing of vehicles
	5.2 Boats
	5.2.1 Purchase small boat (18ft, 115hp)
	5.2.2 Purchase big boat (28ft, 2x150hp)
	5.2.3 Major servicing of small boat
	5.2.4 Major servicing of big boat
	5.2.5 Periodic servicing of boats
	5.2.6 Pier rental
	5.3 Other equipment: field equipment, staff equipment, communication equipment, AV equipment, office equipment
	5.3.1 Field equipment
	5.3.2 Communication equipment
	5.3.3 Audio Visual equipment
	5.3.4 Staff equipment
	5.3.5 Office equipment
6 Finance and administration:	Financial management and administration of the park management organization
	6.1 Accounting
	6.1.1 Bookkeeping (costs and revenues)
	6.1.2 Cashier
	6.1.3 Annual financial accounts
	6.1.4 Audit: included in the overhead costs
	6.2 Administration
	6.2.1 Office administration
	6.2.2 Stock administration (or periodic inventory office supplies, souvenirs, equipment, material)
	6.2.3 Personnel administration
	6.3 Fundraising
	6.3.1 Fundraising administration (government subsidies, fees, grants, donations, souvenir sales)
	6.3.2 Collect dive, yacht, nature and (guided) hike fees: included in 2.1.5
	6.3.3 Purchase of souvenirs
	6.3.4 In house souvenir shop including complete inventory --> only as fundraising tool if income exceeds (investme
7 Management:	Overall management of the park management organization
	7.1 Planning
	7.1.1 Annual action plan per protected area for infrastructure, education and monitoring activities
	7.1.2 Annual budget and investment plan per protected area matching the action plan
	7.2 Coordination
	7.2.1 Coordinate implementation of the action plan
	7.2.2 Day-to-day coordination of park activities
	7.2.3 Implement and manage communication plan
	7.2.4 Interact with stakeholders, government, prosecutor and police
	7.3 Staff management
	7.3.1 Recruitment of staff, interns and volunteers
	7.3.2 Day-to-day management of staff, interns and volunteers
	7.3.3 Periodic evaluation of staff
	7.3.4 Keep up to date job descriptions of each function
	7.3.5 Staff development and training
	7.4 Fundraising
	7.4.1 Grant proposal writing
	7.4.2 Application to grants exceeding USD 50,000 --> DCNA?
	7.4.3 Implement membership/sponsorship/appreciation/donor programme --> DCNA ?
	7.5 Reporting
	7.5.1 Periodic (quarterly) reports to Board and Island Council
	7.5.2 Annual report
	7.5.3 Donor reports (government subsidies, grants, donations)

3. Annual budget requirements

3.1 Methodology

We first identified the methodology applied in The Netherlands for nature management; this method is summarized in paragraph 3.2. Annual budget requirements for nature management of Caribbean Netherlands are presented in a similar structured manner as is done in the Netherlands, where nature management budget requirements are standardized to the area of the different habitats managed.

We considered this methodology useful to apply in Caribbean Netherlands, because it helps to quantify in a structured way the activities which need to be performed, it standardizes budget requirements per habitat, it can be used as a planning and management tool for managers. In the Netherlands it is used as a tool to allocate government subsidies as it justifies budget requirements for park management. Furthermore the Dutch methodology matched with our activity-based cost approach.

To monetize the core management tasks we took this activity-based cost approach rather than a functional-based cost approach. A functional-based cost approach groups the costs by department or function required to manage a park, as opposed to activities [2]. Activity-based costing is a costing methodology that identifies activities in an organization and assigns the cost of each activity according to the actual financial and human resource use [3].

In our approach we identified the direct labour and material needed per activity to carry out the task, based on specific, measurable activities. We quantified how much staff time, use of fixed assets and variable material is needed per unit of activity. We then multiply the units of activity with the staff salaries, depreciation costs and material costs.

Besides these *direct costs* of nature management we also included *indirect costs*. Indirect costs include *fixed costs* or *overhead costs* needed for operating an organization, such as rent and utilities of buildings and office staff. Indirect costs do not change as a function of the activity of the organization. In the calculation of direct costs of the activities we also included a margin for indirect costs.

3.2 Methodology applied in the Netherlands for nature management

In the Netherlands, every other year a book is published on the standards of costs for management activities in nature, forest and landscape; the *Normenboek Natuur, Bos en Landschap* (Van Raffe and De Jong, 2014). The book is used by managers to assess the costs of their activities, and by authorities to determine the amounts of subsidy.

The standards are based on an assessment of time, costs and rates for labour, equipment and materials required to perform management activities. Activities, such as clearing woods and construction of paths, are subdivided into a number of operations. For each operation, costs are based on the following variables:

- The required duration
- Rates for labour and equipment per hour (production means)
- Multiplication of duration and production means

This method for estimating the costs of activities is rather labour intensive (van Raffe, pers. comm.).

The supplementary CD-rom is a user-friendly tool to assess the cost of all activities, including a short explanation of the activity, the influencing factors, the cost standards, and the underlying calculation (Fig. 3.1).

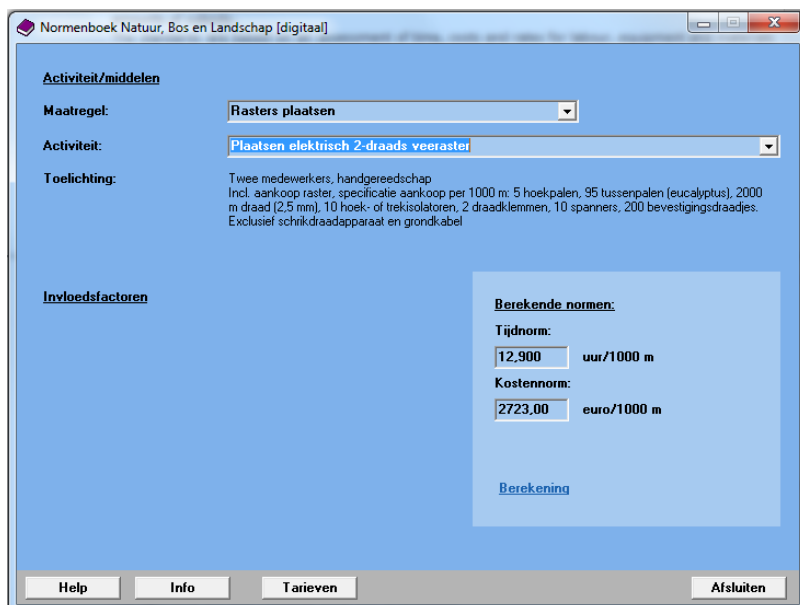


Fig. 3.1: Screenshot of the CD-rom version of the Normenboek Natuur, Bos en Landschap (Van Raffe and De Jong, 2014). A total of 26 measures [maatregel] are subdivided in a subset of activities [activiteit]. In the explanation [toelichting] the required labour, equipment and material are summarized. The influencing factors [invloedsfactoren] are taken into account if applicable, e.g. soil condition wet/dry. The calculation standards [berekende normen] show the required time [tijdnorm] and budget requirement or cost standard [kostennorm]. The breakdown of the calculation [berekening] is presented in another window (Fig. 3.2).

Productiemiddel	Aantal	Tarief/prijs	Totaal
Handgereedschap (niet-gemotoriseerd)	25,800 uur	€ 0,30	€ 7,74
Medewerker, Uitvoerend	25,800 uur	€ 29,20	€ 753,36
Bevestigingsdraadjes, 100 stuks	2,00 100 stuks	€ 18,20	€ 36,40
Draadklemmen	2,00 stuk	€ 0,90	€ 1,80
Tussenpaal, zelfisolierend, 1,5 m lang, 3,8 cm dik	95,00 stuk	€ 10,15	€ 964,25
IJzerdraad; diameter 2,5 mm, 100m	20,00 100 m	€ 11,90	€ 238,00
Hoek- of trekisolator, UV-bestendig, trekk. 200 kg	10,00 stuk	€ 1,25	€ 12,50
Hoekpaal, zelfisolierend, 2,5 m lang, 10 cm dik	5,00 stuk	€ 44,35	€ 221,75
Roterende spanners	10,00 stuk	€ 3,30	€ 33,00
Totaal excl. overhead			€ 2268,80
Totaal incl. (20%) overhead (afgerond)			€ 2723,00

Fig. 3.2 Screenshot of the CD-rom version of the Normenboek Natuur, Bos en Landschap (Van Raffe and De Jong, 2014) showing the breakdown of the cost standard calculation [berekening kostennorm].

Duration

The required duration of a management activity is assessed empirically, by measuring the time needed in the field. Since more people may be involved in carrying out the same operation, the total number of man-hours is considered, too. The standards for duration also include:

- preparation of the work and consultations;
- irregularities (e.g. any other handlings required; fixing technical malfunctions, waiting time);
- transfer time from one object to the other;
- rest and personal care (use of toilet, drinks, snacks).

The standards for duration exclude unproductive hours (e.g. due to illness, training, holdup by weather conditions). These costs are assumed to be included in the hourly rate for labour.

Rates

Rates for labour and equipment are specified per unit of time. Also costs for materials and by-products are as much as possible included here.

Overhead costs, amounting 20% (for administration services, commuting expenses, and operational management) are also included, while VAT is excluded.

Excluded are costs involved in contracting third parties, and the work involved in its management (contacting, contracting, supervising).

Cost standard

The final cost standard is calculated by multiplying the duration with the rates of personnel and machines, and the costs for the amount of material(s) used.

Updating

Regular updates of cost estimates are made, based on desired adjustments from the users of the book, changes in working methods, and priorities. In some cases, existing information must be adjusted in case of changes in the duration of the operations or changes in cost rates. Also new activities may arise for which cost standards need to be developed. A procedure has been developed on the primary process of updating the book, which actively includes the users of the book.

Limitations

The book has been prepared for the Dutch situation, and includes relevant activities for terrestrial sites, only. It does not apply to marine environments. However, the methodology seems suitable for expanding to other types of environment. The costs standards would need to be adapted to the Caribbean Netherlands situation, e.g. different activities and also different context such as climate, infrastructure, excess to facilities etc. An activity may include several actions, which are performed with a defined set of labour, equipment and material.

The following activities in the Dutch situation are considered relevant for the terrestrial sites in Caribbean Netherlands, although these need to be adapted to e.g. vegetation types in Caribbean Netherlands:

- a. Planting
- b. Removing undesired vegetation
- c. Enclose woody vegetation
- d. Clearing woody vegetation and trees
- e. Installing fences
- f. Removing fences
- g. Installing facilities for recreation
- h. Construction of roads and paths
- i. Maintenance of roads and paths
- j. Construction of watercourses
- k. Construction of other facilities

Other activities relevant for nature management in Caribbean Netherlands have been added on the basis of Table 2.5, and budget requirements were specified for these, see 3.3, and Appendix B.

3.3 Breakdown management activities into resource needs

The annual budget requirements of the core tasks for Bonaire, Saba and St. Eustatius are presented in table 3.1: approx. USD 1,461,000 for STINAPA (including an investment of USD 88,000), USD 669,000 for STENAPA and USD 669,000 for SCF.

In the following paragraphs we explain and justify our sources, choices and assumptions. The precise calculation of the budget requirements – specified at activity level - can be found in Appendix B.

Table 3.1 The budget requirements of STINAPA on Bonaire, STENAPA on St. Eustatius and SCF on Saba.

		BUDGET REQUIREMENTS PER ISLAND				
Resp. no.	Responsibilities	Task no.	Tasks	Total costs Bonaire	Total costs Statia	Total costs Saba
1	Infrastructure:		Installation, periodic inspection and maintenance of infrastructure within park			
		1.1	Trails	126,197	55,048	50,609
		1.2	Roads	177,078	-	-
		1.3	Paved area	4,097	300	600
		1.4	Buildings	74,910	17,873	17,085
		1.5	Signage	8,081	3,103	2,237
		1.6	Demarkation boundaries	13,669	-	-
		1.7	Marine structures: moorings, pilings	25,008	8,544	12,135
		1.8	Freshwater structures: wells, ditches	798	33	-
		1.9	Other terrestrial structures	1,227	-	-
				431,063	84,902	82,666
2	Public awareness and education:		Provide information about protected areas to visitors, outreach to the public			
		2.1	Information to protected area users	99,687	66,437	67,269
		2.2	Outreach to the public at large	14,193	14,193	16,736
		2.3	Education programmes to young people	49,289	27,383	14,865
		2.4	Stakeholder advice and involvement	8,613	8,613	8,613
		2.5	Maintain media relations	2,850	2,850	2,850
				174,632	119,476	110,333
3	Monitoring and research:		Basic biodiversity and socio economic monitoring of the protected areas			
		3.1	Ecological monitoring on priority areas	46,151	46,151	71,801
		3.2	Pest control of invasive species	123,512	53,176	23,232
		3.3	Habitat/species restoration	123,512	53,176	76,752
		3.4	Abiotic monitoring	2,230	2,230	2,230
		3.5	Socio economic monitoring	855	855	855
		3.6	Research programmes	23,451	23,451	23,451
				319,711	179,040	198,321
4	Patrolling and enforcement:		Presence within protected areas to provide information and assistance and enforce user fees, user permits			
		4.1	Patrol protected areas	83,599	36,709	16,746
		4.2	Enforce user fees, user permits	6,039	6,039	6,039
				89,639	42,748	22,785
5	Equipment:		Provision and periodic inspection and maintenance of park equipment			
		5.1	Cars	111,520	34,314	31,114
		5.2	Boats	49,399	25,279	25,279
		5.3	Other equipment	12,764	8,594	8,138
				173,683	68,187	64,531
6	Finance and administration:					
		6.1	Accounting	31,675	15,838	15,838
		6.2	Administration	42,932	22,738	22,738
		6.3	Fundraising	5,049	5,049	5,049
				79,656	43,624	43,624
7	Management:		Overall management of the park management organization			
		7.1	Planning	6,062	6,062	6,062
		7.2	Coordination	39,936	39,936	39,936
		7.3	Staff management	68,631	35,577	37,850
		7.4	Fundraising	9,093	9,093	9,093
		7.5	Reporting	8,579	8,579	8,579
				132,301	99,247	101,521
			Subtotal core activity costs	1,400,686	637,224	623,780
			Subtotal overhead costs	61,000	31,600	45,100
				1,461,686	668,824	668,880

3.3.1 General costing principles

We built an analytical calculation model to estimate the annual budget requirements (cf. Appendix B). For the model we first identified which direct labour, equipment and material are needed to carry out the tasks, based on specific and measurable activities. For each activity we identified the most appropriate unit to quantify the activity (e.g. km for trail maintenance, m² for building maintenance, no. of schools for education) and the frequency to carry out the activity (e.g. weekly, monthly, once in 5 years). Following, we quantified per unit of activity the needed staff and time, the use of the main fixed assets (cars and boats) and the main materials (for e.g. buoys, fences, signage), or the costs of third parties for activities carried out by a professional from outside the park management organization. Finally, we multiplied the frequency of activity with the units of activity and with generic staff salaries (cf. Appendix C), vehicle running costs and material costs.

Besides these *direct costs* of nature management we also included *indirect costs*. In the calculation model we included a margin for indirect staff time in the hourly salary costs, namely 20% overhead costs to cover holiday, illness, meetings and training. Appendix C shows the hourly salary costs and the calculation method.

In the calculation model we also included depreciation of all fixed assets (vehicles, field equipment, communication equipment, audio visual equipment, staff equipment and office equipment) as an indirect cost. Although some of the fixed assets (vehicles and field equipment) can be considered direct costs related to the activities, it was considered more accurate to include fixed annual costs (depreciation, maintenance, etc.) as fixed indirect costs that do not change as a function of the activities. Appendix D shows the annual costs of all fixed assets.

We took a lumpsum amount for other overhead costs needed for operating a park management organization (e.g. office rent and utilities, office running costs, communication expenses, insurances and taxes and staff travel costs) based on the audited annual accounts of STINAPA (Ernst & Young 2013), STENAPA (Ernst & Young 2012a) and SCF (Ernst & Young 2012b).

3.3.2 Trails (Activity 1.1)

The trail network on St. Eustatius is 27.2 km (H. Madden, pers. comm.) and we estimated the trail network on Saba is 25 km, based on the Google Earth trail map [4]. In Washington Slagbaai National Park on Bonaire there are three hiking trails and some trails to viewpoints [5] with an estimated length of 7 km.

Trail maintenance differs on Saba and St. Eustatius compared to Bonaire, due to differences in vegetation. On Bonaire trails are not heavily overgrown, maintenance mainly consists of trimming shrub, which takes 1,5 hours to check and trim a trail of 1 km and should be done twice per year, we assumed. Due to the steep terrain and the dense and fast growing vegetation, the extensive trail networks on Saba and St. Eustatius require substantial regular maintenance. Saba Conservation Foundation has two types of trail maintenance, regular monthly or 2-monthly trail maintenance which is done by a third party and annual big maintenance through a Canadian volunteer program [6], which started 20 years ago with groups of around 7 volunteers offering assistance in trail maintenance during two weeks per year, doing heavy work such as creating stone steps, removing large boulders and securing passage in areas of loose earth, where natural erosion occurs. The trail manager assists and works on the trails year round. We accounted for the volunteers as seven rangers working 80 hours a year (560 hours in total) to do the heavy maintenance on a section of the 25 km of trails on Saba, resulting in on average 22.4 hours (560 hours/25 km) to maintain a trail of 1 km. The regular small maintenance by the third party is costing approximately 40.000 USD and equals 8 hours per km per month to cut and remove vegetation. Given the similarities in the vegetation and terrain on St. Eustatius, we assumed the costs per km are similar for the trail maintenance by STENAPA.

Placement of new trails, connecting or rerouting existing trails, and restoration of former trails which disappeared and were reclaimed by nature also occurs (SCF 2015). We assumed placement or complete restoration takes twice as much time as the annual heavy maintenance (44.8 hours for a trail of 1 km), and we assumed on average the trail network is extended with 10% (2.7 km on St. Eustatius and 2.5 km on Saba).

Mangrove maintenance is only applicable at Lac Bonaire, which has almost 300 ha of predominately red and black mangroves as well as mixed mangrove forest (Davaasuren and Meesters, 2011). Routine mangrove channel maintenance by lateral trimming of mangrove trees is needed at one year intervals (http://manatee.ifas.ufl.edu/seagrant/pdfs/Mangrove_Trimming_Guidelines.pdf) in order to keep the channels open and maintain water circulation and water quality (Debrot et al., 2010). The total length of mangrove channels to maintain in Lac is 3450 m, of which only 740 m is currently in good shape and at least 4 m wide; 698 m is partially closed and only 2 m wide; and 2140 m of channels are currently overgrown and completely closed (S. Engel, pers. comm.). The overdue big maintenance costs to broaden the partially closed channels are USD 20 per meter, the costs to open the closed channels are USD 35 per meter. The routine annual maintenance costs to keep channels in good shape are USD 10 per meter, so the annual maintenance will cost USD 34,500 for the 3450 m of mangrove channels (N. Oleana via S. Engel, pers. comm.) This routine annual maintenance is assumed to be done by two rangers who work on this year round 2 days a week. This brings the estimated staff time to maintain a channel of one meter at 0.6hr (52 wk*16 hr*2 p / 3450 m channel) and USD 36,988 including running costs of the boat. We included as additional big maintenance costs the broadening and clearing of 698 m channel at USD 20 m⁻¹ and the complete opening of 2140m at USD 35 m⁻¹. These additional overdue maintenance costs of USD 88.000 will be a one-time investment cost, which will increase the costs in the first year only.

3.3.3 Roads (Activity1.2)

On Bonaire the roads in the national park are maintained by STINAPA. On St. Eustatius the few roads within the park boundaries are maintained by the government and on Saba there are no roads within the park boundaries. Washington Slagbaai on Bonaire has 42 km of roads, of which 70% (29.4 km) are dirt roads and 30% (12.6 km) are paved roads (STINAPA 2015). Dirt roads require much more frequent maintenance than paved roads, especially after periods of rainfall. Cars shove material to the outside, leading to rutting, reduced water-runoff, and eventual road destruction if unchecked. Grading [*uitvlakken*] is sufficient to push the material back into shape [7], scraping [*schaven*] the surface is done afterwards to redeposit the material in an even layer [8]. Grading and scraping of dirt roads needs to be done by a third party with specialized equipment every other year, which will cost USD 1300 per day, and which will take 1 day to grade and scrape 1 km (J. Statia, DRO, pers. comm.). Other annual maintenance of dirt roads concerns just scraping the surface, which will go 5 times faster (1.6 hours) and therefore costs USD 260 per km (J. Statia, pers. comm.), and trimming of the shrub along the road, which takes a ranger 1,5 hours to check and trim a road of 1 km and should be done twice per year, we assumed. We assumed a ranger will provide logistics support to the third party, so 8 hours per km when grading and scraping, and 1.6 hours per km when only scraping.

Paved road construction by a third party costs between USD 260 and USD 1.000 per meter depending on the width and type of road (J. Statia, pers. comm.) and between USD 1010 and USD 1150 per meter for 6m broad and respectively 7 cm and 10 cm thick concrete layer according to another quotation (M. Zwiers, BWM infrastructure, pers. comm.). We assumed the investment costs to construct a new road are USD 1000 per meter (USD 1 million per km). Annual road maintenance costs about 3 to 4% of the construction costs, which is between USD 7,800 (3% of USD 260 * 1000m) and USD 40,000 (4% of USD 1.000 * 1000m) per km per year (J. Statia, pers. comm.). The presumably more accurate quotation from BMW infrastructure is that a new road requires maintenance each seven year by replacing the top 3 cm, which costs USD 450 per meter (Martijn Zwiers, pers. comm.).

This results in our estimate of big maintenance each 7 years of USD 450,000 per km, which equals USD 64,285 per km per year and is slightly higher than the above estimate of USD 40,000. Additional maintenance by the rangers to remove rocks and shrub and do small repairs was estimated at 4 hours per km.

3.3.4 Paved area and Buildings (Activities 1.3-1.4)

In order to calculate the depreciation costs of paved area and buildings we estimated building costs per surface area based on quotations, multiplied by estimated surface areas using Google Earth. For Bonaire we estimated the following surface areas: STINAPA office (300 m²) and storage (80 m²), Washington Slagbaai park entrance offices (100 m²), storage (70 m²), visitor center (115 m²), public bathrooms (25 m²), guesthouse (125 m²) and historic buildings in the park (610 m²), porches (250 m²) and parking lots (200 m²). For St. Eustatius we estimated the following surface areas: STENAPA office (75 m²) of which a third is visitor center (25 m²) and the remaining 50 m² is used as office space, storage (80 m²) and public bathrooms (15 m²), two buildings (80 m² and 65 m²) and a small storage (25 m²) at the botanical garden. On Saba there are 2 buildings, the office (180 m²) with underneath storage (120 m²) and the trail shop (25 m²).

Price estimations for concrete constructions ranged from USD 1000 to USD 1200 per m² on St. Eustatius (S. Dijkshoorn, pers. comm.) and from USD 900 to USD 1200 per m² on Bonaire (J. Statia, pers. comm.), therefore we took an average USD 1100 per m². For porches with a concrete surface and rooftop we estimated the price at a third of this (USD 367 per m²) and for wooden boardwalks we estimated the price at USD 100 per m² (D. Debrot, pers. comm.). The depreciation period depends on the type of construction, e.g. 40 years for solid concrete construction (S. Dijkshoorn, pers. comm.). However, the depreciation period applied in the financial statements of SCF, STENAPA and STINAPA varies from 40 years on Saba (Ernst & Young 2012a), 15 years on St. Eustatius (Ernst & Young 2012b) and 25 years on Bonaire (Ernst & Young 2013). We used as average depreciation period 25 years to calculate the annual depreciation/big maintenance costs. This follows actual depreciation for STINAPA, slightly overestimates the 40 years depreciation for SCF (approx. 5,000 USD, cf. calculation model) and slightly underestimates the 15 years depreciation for STENAPA (approx. 10,000 USD, cf. calculation model). For wooden boardwalks we used a depreciation period of 5 years. On Saba SCF planned to construct 3 new boardwalks and lookouts at the Mount Scenery trail (SCF 2015) which we estimated to be 5 m² each. We estimated all parks already have 15 m² of boardwalks at the various trails on Saba and St. Eustatius and access points to beaches in Washington Slagbaai National Park.

We added cleaning costs of 4 hours per 160 m² (0.025 hr m⁻²) per week for all buildings as interior maintenance costs.

3.3.5 Signage (Activity 1.5)

Two types of signage in the national parks are distinguished: visitor information boards at points of interest and indication signposts to direct visitors to points of interest and at intersections of trails and roads. On Bonaire there are mainly indication signs, 35 in Washington Slagbaai (30 existing and planned new signs, STINAPA 2015) and 60 at the Marine Park (8 existing signs and planned new signs in Lac and Klein Bonaire, as well as shore dive markers, STINAPA 2015). On St. Eustatius there are a number of information boards on the hiking trails, which we estimated at 20, and approximately 10 signposts. On Saba we estimated there are 5 information boards and 20 signposts.

We guesstimated the production costs of an information board at USD 500 and the material costs of signpost at USD 100 including annual maintenance, and the depreciation period at 5 and 2 year respectively. We guesstimated staff time to install an information board at half a day, and to install and maintain a board at 4 hours per 2 years. The design of information boards is accounted for under core responsibility of public awareness and education (2.1).

3.3.6 Demarcation boundaries and Marine structures (Activities 1.6-1.7)

Fences are only used in Washington Slagbaai National Park on Bonaire. Slagbaai is separated from the Washington area with a perimeter fence to prevent goat movement, and there is a fence from the eastern boundary at Boka Onima to the south-eastern boundary at Salina Goto, resulting in 12 km fence in total. The material costs of USD 4357 for 1 km fence are based on quotations from Kooyman Bonaire for the following materials: Field fence 330' GA 12.5 [*kabrietengaas*] 91m for USD 280, multiplied by 1000m/91m is USD 3077; post fence T-stud 6 feet [*staka*] to attach the fence every 10m for USD 10, multiplied by 1000m/10m is USD 1000; barbed wire 402.6m for USD 75, multiplied by 1000m/402.6m is USD 186; and tie wire PVC-coated 1.4mm [*binddraad*] 50m for 48, to attach 100 staka 12 packages are needed, costing USD 96. Staff costs to place 1 km fence are estimated at 100 hours for 4 rangers and the fence will last for an estimated 10 years.

For marine demarcation of marine reserve and fish reserve boundaries, markers used are similar to mooring buoys, so costs are considered identical to mooring buoy placement and maintenance. We included the demarcation buoys therefore in the total number of buoys under activities 1.7.1 and 1.7.2. The demarcation and mooring buoys used are different on Saba and St. Eustatius compared to Bonaire. Saba moorings are 45cm float balls [12] and St. Eustatius uses these float balls as well (Fig. 3.3, left), while Bonaire developed special PVC pipe-buoys to be used as moorings (Fig. 3.3, middle and right).



Fig 3.3: Different mooring buoys used on Saba and St. Eustatius (left) and Bonaire (middle, right, photos www.bmp.org).

Based on information from the park managers on Bonaire and St. Eustatius we calculated the average annual depreciation costs. On Bonaire a mooring costs USD 600 for material and USD 400 for placement, and lasts for 10 years, making the annual costs USD 100. On St. Eustatius a mooring costs USD 388 for material plus staff time, which we estimated at 8 hours (USD 132) as the balls are purchased and only the rope needs to be prepared before placing the mooring in the water. The float balls last just 5 years, resulting in annual costs of USD 104. We used the slightly higher float ball costs in our calculations. The annual maintenance costs are approximately USD 100 per year (R. de León, pers. comm.), which we entered in the calculation model as on average 1.5 hours to check, scrape and if necessary paint a mooring three times a year.

None of the park management organizations owns and maintains piers or slipways. These are government owned and in Bonaire the pier is rented from Harbour Village Marina, which costs are included under activity 5.2.6.

3.3.7 Freshwater structures and Terrestrial structures (Activities 1.8-1.9)

Bonaire has a number of ancient freshwater structures which need to be maintained by hand, and a number of modern freshwater structures which can be restored with a bulldozer. Pos Labra and pos Nobo are wide wells which require big maintenance of the well rim and dredging by hand every 5 years, which will take a ranger two days we estimated.

Pos Bronswinkel is a historic spring structure which requires half a day for two rangers to scrape out excess sediment every year. Pos Manzalina and pos Rooi Hoeba are modern pos di pia which can be restored every 5 years with a bulldozer in half a day. Pos Salu, pos Palmit, pos di Seru Juwana, pos di Kabritu are pos di pia which do not need to be maintained. There is one dam at pos Labra which also be restored with a bulldozer, once every 10 years, and takes one day. The costs of bulldozer are USD 475 per day (J. Statia, pers. comm.). There is also one windmill, also at Labra, which lasts 60 years and costs USD 4350 to be placed. We assumed the small maintenance of trimming bushes around the wells and pos di pia requires 2 hours each year.

Bonaire also has a number of other terrestrial structures, such as the paved labadó's in the dirt road, the livestock grids in the road at the two borders separating Washington and Slagbaai, and livestock corrals around the freshwater structures to keep the livestock out. We included the approximately 10 labadó's, small stretches of paved road, under activity 1.2.6. The costs of the 7 livestock corrals of approximately 100 meter (0.7 km) are the same as the fences, cf. activity 1.6.1. For the calculation of livestock grids we used the Dutch normenboek as guideline, resulting in 4 hours staff time of 4 hours, and at the equivalent amount in USD of the material costs (fig. 3.4 and 3.5). Price differences between the Netherlands and Caribbean Netherlands and exchange rates were left out of our estimation, but need to be taken into consideration for an accurate estimate if the calculation model is validated.

Fig. 3.4: Screenshot of activity 'placement of livestock grids [plaatsen veerooster] in the Normenboek Natuur, Bos en Landschap (Van Raffe and De Jong, 2014). The calculation standards [berekende normen] show the required time [tijdnorm] is 3.1 hour and the cost standard [kostennorm] is EUR 2,797. The breakdown of the calculation [berekening] is presented in another window (Fig. 3.5).

Productiemiddel	Aantal		Tarief/prijs	Totaal
Medewerker, Uitvoerend	3,100	uur	€ 29,20	€ 90,52
Hydraulische graafmachine (wielkraan)	3,100	uur	€ 32,90	€ 101,99
Veeerooster, 1,7 x 2,1 x 0,5 m	1,00	stuk	€ 2138,00	€ 2138,00
Totaal excl. overhead				€ 2330,51 ⁺
Totaal incl. (20%) overhead (afgerond)				€ 2797,00

Fig. 3.5 Screenshot of activity 'placement of livestock grids [plaatsen veeerooster] in the Normenboek Natuur, Bos en Landschap (Van Raffe and De Jong, 2014) showing the breakdown of the cost standard calculation [berekening kostennorm].

3.3.8 Public awareness and education (Activities 2.1-2.5)

Saba Conservation has five user information brochures: The nature of Saba; History of Saba, Diving in Saba, Anchorage Saba; and the Hiking trail map. The latter is in the process of being updated and the other four are from 2005 and require to be updated [9]. STINAPA currently has five brochures as well: Bonaire National Marine Park, Washington Slagbaai National Park, Lac, Visitor center; and Boating. The brochures are also approximately 10 years old, the boating brochure even older. STENAPA provides a general information brochure and five other brochures: Diving in Statia Marine Park, Yachting in Statia Marine Park, The Quill National Park (2003), Miriam C. Schmidt Botanical Garden and Nature on Statia. We also accounted for several flyers and posters to be maintained by the park management organizations on a more ad-hoc basis, and estimated the total number of brochures at 7 for each park management organization.

For the staff time required to develop a brochure (activity 2.1.1), outdoor visitor display (activity 2.1.3) or indoor visitor display (activity 2.1.4) we took a lumpsum of 100 hours per item per 10 years, after which we assume it requires to be updated or renewed. For the development of new (thematic) trails we also calculated 100 hours, with 1 new (hiking, snorkel, etc.) trail to be developed annually. For outdoor information boards the placement costs by a ranger are included in activity 1.5.1, as are the third party costs to produce the board. For indoor information boards these costs are accounted for under activity 2.1.4.

The third party costs to design and produce brochures (activity 2.1.2) are estimated at resp. 500 USD for the design and USD 0.5 for one full color print of a brochure, multiplied by the number of visitors: 38,000 visitors of the Bonaire Marine Park [10] and 23,000 visitors to Washington Slagbaai National Park [11], rounded up with approx. 10% to 70,000 brochures; STENAPA recorded in 2012 962 divers, 384 yachts and 548 hikers, highest numbers were recorded with 2250 divers (in 2008), 460 yachts and 1068 hikers (both in 2004) (STENAPA 2012), rounded up to 5000 brochures; SCF recorded in 2010 8293 divers, 359 yachts and 2286 hikers (SCF 2010), rounded up to 14,000 brochures. To ensure park entrance fees are collected from all visitors (excluding divers who are paying through the dive operators), a ranger is included for 8 hours a day (activity 2.1.5), not only in Washington Slagbaai, but also in the trail shop on Saba and in the visitor center annex office on St. Eustatius. A ranger for guided tours is also included for 3 hours a week (activity 2.1.6).

Established outreach activities for the public at large are a quarterly newsletter and a facebook account maintained by STENAPA. Saba Conservation Foundation maintains four facebook accounts: a general Saba Conservation Foundation page, as well as facebook accounts for the Snorkel Club Saba, the Saba National Marine Park, and the Saba Bank National Park. We included for all parks the following staff time requirements for outreach: 100 hours per year to maintain the website, 1 hour per week for social media posts, 40 hours per quarter for newsletters, and 16 hours per quarter for local presentations. We used the staff function education officer, because apart from STINAPA the function communication officer does not exist with SCF and STENAPA. This does not influence the budget requirements though, as both functions are in the same salary scale. As additional cost we also included third party fees for technical assistance to maintain the website.

The outreach activities for children can be divided in in school programs and out of school programs. On Bonaire there are 8 primary schools and 1 secondary school, on St. Eustatius there are 4 primary schools and 1 secondary school and on Saba there is 1 primary school and 1 secondary school [13]. We followed the list of management tasks of DCNA (appendix A) to provide at least one in school program at each school each year (16 hours including preparation), with the exception of SCF who has a monthly school visit in place (12 programs at one school per year). For out of school programs we calculated 4 hours per week per school, including preparation time.

For stakeholder related activities we guesstimated two local community/fishermen/business meetings a year of 40 hours including preparation time, and one day a month for the park manager and general director. To maintain media relations we guesstimated one day a month is needed for press releases and half a day each quarter the park manager gives interviews. We did not include participation in DCNA regional and international media strategy, although some park managers may participate in such events as members of the DCNA board.

3.3.9 Monitoring and research (Activities 3.1-3.6)

We divided monitoring and research in six main tasks: Ecological monitoring of priority ecosystems/species (activity 3.1), pest control of invasive species, roaming livestock and feral domestic animals (activity 3.2), habitat/species restoration (activity 3.3), abiotic monitoring (activity 3.4), socio economic monitoring (activity 3.5) and research programmes (activity 3.6).

We propose three levels of involvement of park management organizations in these core tasks, which is illustrated in figure 3.4. If the activity is curiosity driven research (e.g. butterfly monitoring) the role of the park management organization is to facilitate this by providing logistics support and in return ask researchers to contribute to the costs incurred. If the activity is applied research which is of local interest (e.g. habitat mapping of the protected area) the role of the park management organization is to assist with staff and logistics support.

If the activity involves essential monitoring to collect basic abiotic and biotic data, which data can be used and analyzed in applied and curiosity driven research, there is an active role for the park management organization to collect this data on a regular basis (e.g. fisheries sampling). The tasks can be carried out by rangers and/or park managers depending on the qualifications required.

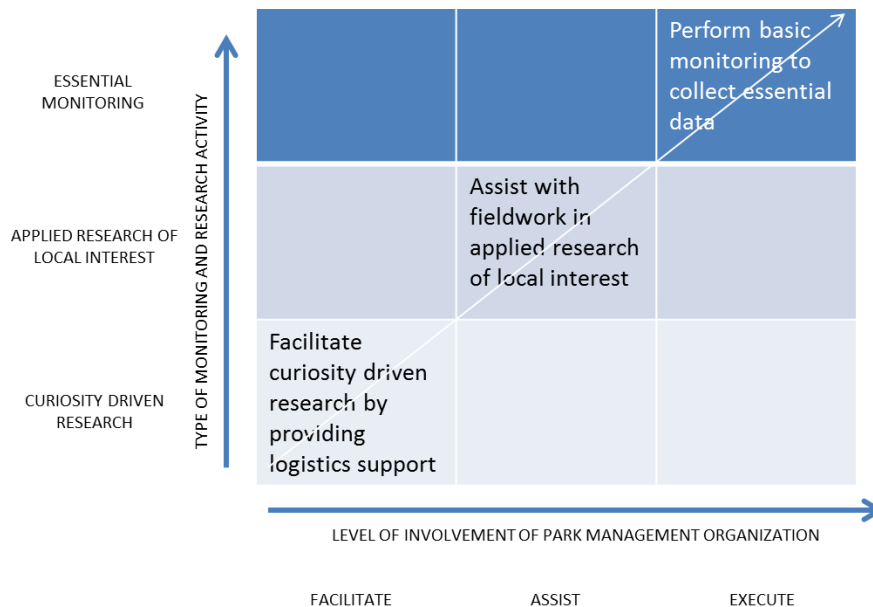


Fig. 3.4 Illustration of three levels of proposed involvement by park management organizations (facilitate, assist and execute) in three types of monitoring and research activities (curiosity driven, applied research and essential monitoring).

The tasks can be carried out by rangers and/or park managers depending on the qualifications required. It is difficult to quantify the variety of monitoring tasks accurately. Of the six main tasks we consider habitat and species restoration as the premier goal of nature conservation, which involves besides protection and preservation also restoration from losses or damage to habitats and species. Damage control of invasive species almost always involves not only removal efforts, but also habitat restoration efforts to establish native species which will prevent the re-establishment of invasive species (Eiswerth and Johnson 2002). The level of management effort depends on biological and ecological factors such as growth rate and carrying capacity (Eiswerth and Johnson 2002). In the case of lion fish removal efforts will be costly and complete eradication through removal efforts is highly unlikely and only feasible at relatively small spatial scales (Barbour 2011). We assumed removal efforts remain necessary over time and we used as general rule of thumb park rangers spend of an average work week most of their time on pest control, followed by habitat restoration and threatened species: 1,5 day on invasive species control (activity 3.2); 1 day on habitat restoration (activity 3.3.1 and 3.3.2), and half a day on implementation of threatened species management plans (activity 3.3.3 and 3.3.4). Other monitoring tasks will on average take: 1 hour per week to collect abiotic monitoring data (activity 3.4.1), 1 hour per week (or 4 hours per month) to collect water quality data (activity 3.4.2), 1 hour per week to collect socio-economic monitoring data (activity 3.5) as well as on average half a day per week to facilitate visiting researchers (activity 3.6), assist the park manager with fieldwork and collect routine, basic monitoring data (activity 3.1.2 and activity 3.1.4). This adds up to 4 days a week and leaves one day a week for patrolling/active surveillance, while passive surveillance/presence can take place during field presence when carrying out the above activities.

We furthermore assume that the terrestrial and marine park managers spends on average 1 day each on assisting in applied research and collecting basic monitoring data, which requires their expertise (activity 3.1.1 and 3.1.3) as well as 1 day per month each (16 hours for the two park managers) to liaise with researchers to set the research agenda and identify research institutions to address management needs and potential threats to the protected area (activity 3.6.1).

For the budget requirements we used the number of rangers working for STINAPA as our basis. This approach was used, because the other park management organizations are structurally underfinanced and understaffed and have only survived due to periodic financial injections by DCNA or the ministry of EZ over the last years. STINAPA employs 7 marine park rangers and 3 terrestrial park rangers (STINAPA 2015). Taking habitat restoration of 1 day a week as an example we calculated that 10 rangers work 80 hours per week on 87 km² protected area (60 km² terrestrial park and 27 km² marine park). This means on average they work almost 1 hour per km² per week. From this average staff costs of per km² we derived the budget requirements for pest control and habitat/species restoration for STENAPA and SCF, based on the park size. The ecological, abiotic and socio economic monitoring is not related to park size, because we argue that each terrestrial and marine park have similar numbers of reference sites to monitor (water quality at x locations, x number of benthos and fish transects, 1 weather station) and similar features of interest for visiting researchers. The 4 hours ecological monitoring and research assistance by 10 rangers is 40 hours per week of capacity for monitoring and research, which we divided as 10 hours for terrestrial monitoring (activity 3.1.2), 10 hours for marine monitoring (activity 3.1.4) and 20 hours for research assistance (activity 3.6.2).

For the Saba Bank we were able to quantify the monitoring more precisely, as this is an example of applied research by IMARES where the Saba Bank Management Organization, functioning as part of the Saba Conservation Foundation, assists with the fieldwork. Fisheries monitoring on the Saba Bank consists of the following parts: 1) daily fish trip logs, recording the number of boats fishing each day; 2) port sampling "short interviews" (~30% of fishing trips); 3) port sampling "long interviews" including species data collection (~10% of the fishing trips); and 4) on-board sampling (<5% of the fishing trips) (Van Beek et al. 2014). Calculating with 1408 fishing trips per year, 1035 lobster fishing trips (Van Gerwen 2013) and 373 redbfish fishing trips (Boonstra 2014), this means the total fisheries monitoring takes 25 hours per week (1278 hr yr⁻¹ / 52 weeks): part 1); an hour per day (365 hr yr⁻¹) : part 2); 423 trips multiplied by half an hour per interview (212 hr yr⁻¹): part 3); 141 trips multiplied by 1 hour per interview (141 hr yr⁻¹): and part 4); 70 on-board sampling trips of a full day (560hr yr⁻¹). The other monitoring task involves habitat restoration by detecting and removing ghost traps on 3 days per week, which is combined with patrolling and law enforcement. We followed the frequency of this activity as mentioned in the SCF action plan (2014) although it can be argued that this is insufficient to monitor the Saba Bank protected area of in total 2,680 km².

3.3.10 Patrolling and enforcement (Activities 4.1-4.2)

Patrolling is one of the many tasks of rangers. According to our general rule of thumb one day a week is spent on patrolling and according to the same rationale as in the above calculation of monitoring, we used the number of rangers working for STINAPA per km² as our basis and similarly as the duty of habitat restoration of 1 day a week. We calculated that 10 rangers work 80 hours per week to patrol 87 km² protected area (60 km² terrestrial park and 27 km² marine park). This means on average they work almost 1 hour per km² per week. From this average staff cost per km² we derived the budget requirements for STENAPA and SCF.

We did not include additional staff time for keeping record of patrols (activity 4.1.3), checking user fees (activity 4.2.1) and providing information to users (activity 4.2.2) as we argue this is done during patrolling or at the the end of the patrolling shift.

We did include additional staff time for the park manager to review safety protocols (40 hours per year, activity 4.1.4), report incidents and follow up on law/legal enforcement (8 hours per month, activities 4.2.3 to 4.2.5) and assistance in the issuing of permits (8 hours per month, activity 4.2.6). All these activities are independent of the park size and equal for all three park management organizations. Patrolling of the Saba Bank is done in combination with monitoring the Saba Bank, e.g. detecting ghost traps, and is therefore included in activity 3.3.5. Enforcement involves the enforcement of fisheries and other regulations such as size restrictions, trap requirements, conch moratorium and closed spawning areas (Lundvall 2008).

3.3.11 Equipment (Activities 5.1-5.3)

Included in the direct costs are the running costs of the main fixed assets, the vehicles, because this is easy to relate to the activities. We considered it more accurate to include fixed annual costs (depreciation, maintenance, etc.) as a lump sum amount which does not change as a function of the activity. The fixed annual costs of cars are included in activity 5.1, those of boats are included in activity 5.2 and the costs of other equipment are included in activity 5.3.

The number of vehicles were based on the action plans of STINAPA (2014) and STENAPA (2014), only for SCF the number of cars was increased from 1 to 3 based on the required 4WDs needed according to the calculation model (Table 3.2). We also included periodic servicing of the vehicles by the rangers, which we estimated at 8 hours per month per vehicle.

An overview of other equipment and their annual depreciation and maintenance costs is provided in Appendix D. In the calculation model we included the subtotals from Appendix D for field equipment, communication equipment, audio visual equipment, staff equipment and office equipment.

As depreciation period we followed general accounting standards as applied in the financial statements (Ernst & Young 2012a).

3.3.12 Finance and administration (Activities 6.1-6.3)

We divided finance and administration in three main tasks: Accounting (activity 6.1), administration (activity 6.2) and fundraising (activity 6.3). Most of these tasks are day-to-day routines, so we used another general rule of thumb for time that administrative staff spends on bookkeeping (1 hour a day), as cashier (1 hour a day), on office administration (2 hour a day) and on the purchase of souvenirs (0.5 hour per day). Routine weekly activities are stock administration (2 hours a week, or 0.4 hour per day) and routine monthly activities are personnel administration (8 hours a month, or 0.4 hour per day) and fundraising administration (2 hours a month, or 0.1 hour per day). The annual financial accounts we included as two weeks of work (80 hours a year).

To account for the difference in size of STINAPA and STENAPA and SCF we included a factor 2:1 as we calculated the budget and staff requirements of STINAPA are roughly twice as much as for STENAPA and SCF. In our rationale this also means double as much work on personnel, office and financial administration.

3.3.13 Management (Activities 7.1-7.5)

We divided management in five main tasks: Planning (activity 7.1), coordination (activity 7.2), staff management (activity 7.3), fundraising (activity 7.4) and reporting (activity 7.5).

Most of these tasks are periodic activities: We estimated 80 hours per year is needed to prepare the annual action plan (activity 7.1.1), the annual budget and investment plan (activity 7.1.2), and the annual report (activity 7.5.2). We estimated 20 hours per quarter is spend on periodic reporting to the board and island council (activity 7.5.1). Fundraising activities are besides periodic also dependent on the number of grants, which we estimated at a target of 3 grants per year per island. For proposal writing (activity 7.4.1) and preparing donor reports (activity 7.5.3) we estimated 80 hours per year per grant.

More regular activities include coordination of implementation of action plans (activity 7.2.1) and coordination of implementation of e.g. a communication plan (activity 7.2.3), which we included for 10 hours a month each. Day to day coordination of park activities by the park manager is included for 2 hours a day (activity 7.2.2), day to day coordination of staff, interns and volunteers is also included for 2 hours a day (activity 7.3.2). For the latter activity we accounted for the difference in staff numbers working for STINAPA and STENAPA and SCF by including a factor 2:1. Other staff management activities included in the calculation model are staff recruitment, 40 hours per recruitment with an estimated turnover of 20% of the total staff numbers (activity 7.3.1); periodic evaluation of staff, 4 hours per staff member (activity 7.3.3); keeping job descriptions up to date, 1 hour per staff member (activity 7.3.4); and last but not least providing staff development and training, an estimated average of USD 500 per year per staff member for PADI courses, special agent of police trainings (*BOA: Buitengewoon Opsporings Ambtenaar*), exchange programs with other national parks, etc. (activity 7.3.5). The resulting budget requirement for training is approx. 1% of the turnover and 2% of the gross salaries including employer costs. Regional representation and participation by park managers at relevant workshops and conferences is included for 10 days a year.

3.4 Other applications of the calculation model

The calculation model facilitates to calculate the number of staff (full time equivalent (fte) based on 80% of staff time being available for direct activities) and the number of vehicles (based on an estimated 0.7 utilization rate) required to operate the park management organization. This is calculated in separate columns in appendix B: 'Staff requirements per island' shows the ranger time (in hours and fte) needed, as well as total staff time required; and 'Cars required (hours/no.)' shows the 4WD time needed (in hours and no.). An overview of these results is provided in Table 3.2.

The calculated, required staff levels and cars do not differ much from the current situation for STINAPA with 13 cars (STINAPA 2015) and 27 staff members, of which 11 rangers, 3 maintenance rangers and 1 wildlife biologist (STINAPA 2015; [14]). Only staff levels are substantially different for STENAPA with 4 cars and 9 staff members, of which 4 rangers (STENAPA 2015).

For SCF both staff levels and cars are substantially different with 2 cars and 9 staff members, of which 3.5 rangers, calculating the Saba Bank Management Unit head 50/50 as ranger and manager (SCF 2015).

The model also facilitates the calculation of fte needed for any staff function, by selecting the particular function in the column 'staff function', after which the column 'all staff' shows the total for that particular staff function. This has been done for 'education officer' (in the model no distinction is made between education officer, education assistant, communication officer and communication assistant), for 'administrator' and 'cashier', and for 'park manager' and 'general director'. The deviations between calculated, required staff levels and actual staff levels for these functions are also shown.

Table 3.2 The requirements (hours and fte) of STINAPA on Bonaire, STENAPA on St. Eustatius and SCF on Saba, based on the activity based approach of this study.

Staff and cars	required hrs	required fte	actual fte	required no.	actual no.
STINAPA					
Rangers	0	0.0	14+1	-	-
Education/communication officer	3088	1.9	3	-	-
Park manager/director	4985	3.0	3	-	-
Administrator/cashier	3583	2.2	2	-	-
Total staff	3583	2.2	27	-	-
Cars	0	-	-	0.0	13
STENAPA					
Rangers	0	0.0	4	-	-
Education/communication officer	2192	1.3	1	-	-
Park manager/director	4147	2.5	3	-	-
Administrator/cashier	1947	1.2	1	-	-
Total staff	1947	1.2	9	-	-
Cars	0	-	-	0.0	4
SCF					
Rangers	0	0.0	3.5	-	-
Education/communication officer	1634	1.0	1.5	-	-
Park manager/director	4207	2.5	2.5	-	-
Administrator/cashier	1947	1.2	1	-	-
Total staff	1947	1.2	9	-	-
Cars	0	-	-	0.0	2

4. Gap analysis for sustainable financing of nature management

4.1 Previous estimations of annual budget requirements and actual expenses

The annual budget requirements have first been written down in the report *Begroting en financieringsplan* (MINA 2000), which made distinction between 'minimal management needs' and 'basic management needs'. The basic management needs as identified in the above report are shown in Table 4.1A (in red). Only total estimated expenditure is presented, as the breakdown is very different from the current breakdown in the annual financial accounts.

Table 4.1B (in purple) shows the basic management needs of 2000, which were updated in 2014 by applying a 25% inflation correction (equal to an annual inflation of 1.75%).

Table 4.1C (in green) shows a more realistic update of the basic management, also made in 2014. These estimated expenditure include present realistic staffing levels and operating costs. Especially Bonaire and Saba expenditure more than doubled compared to 2000, which can be explained e.g. by changes in the operations such as the Saba Bank management which has intensified with the presence of the Saba Bank Management Unit.

Table 4.1: Basic park management annual budget requirements, based on: A) original estimation in the Begroting en Financieringsplan (MINA, 2000); B) update of the original estimation, including a 25% inflation correction; and C) realistic estimation based on presently realistic staffing levels and operating costs (source: DCNA).

	STINAPA Bonaire	Carmabi Curaçao	SCF Saba	STENAPA St. Eustatius	Nature Foundation St. Maarten
A) ORIGINAL EXPENDITURE 2000					
original Begroting en Financieringsplan (2000)					
Total expenditure ANG/Naf	1,132,000	1,132,000	762,000	780,000	780,000
Total expenditure USD (rate 1 USD = 1.78 ANG)	635,955	635,955	428,090	438,202	438,202
B) UPDATED EXPENDITURE 2014					
updated Begroting en Financieringsplan (2000)					
	US\$	US\$	US\$	US\$	US\$
Human resources					
Staff related	495,084	495,084	291,433	291,433	235,253
Operational costs					
Administration	14,747	14,747	13,343	13,343	11,938
Vehicle/s	25,631	25,631	15,089	20,364	20,364
Boat/s	25,631	25,631	15,089	20,364	20,364
Maintenance - infrastructure	9,831	9,831	9,831	9,831	9,831
Monitoring - research	35,112	35,112	35,112	35,112	35,112
Law enforcement					
Information - education - outreach	6,320	6,320	6,320	6,320	6,320
Visitor Centre	42,135	42,135	42,135	42,135	42,135
Travel - training	2,107	2,107	2,107	2,107	2,107
Projects					
Other operational costs	35,112	35,112	35,112	35,112	35,112
Production of tags and souvenirs					
Booking adj eg depreciation					
Unforeseen (15%)	103,757	103,757	69,838	71,419	62,781
TOTAL expenditure USD	795,467	795,467	535,409	547,539	481,317
Increased budget requirements 2014 vs 2000	159,512 25%	159,512 25%	107,319 25%	109,337 25%	43,114 10%
C) REALISTIC EXPENDITURE 2014					
based on realistic staffing and operational costs					
	US\$	US\$	US\$	US\$	US\$
Human resources					
Staff related	805,000	555,000	615,000	510,000	380,000
Operational costs					
Administration	75,000	25,000	75,000	50,000	25,000
Vehicle/s	90,590	45,295	60,393	30,197	30,197
Boat/s	45,295		30,197	30,197	30,197
Maintenance - infrastructure	80,000	40,000	80,000	80,000	40,000
Monitoring - research	50,000	25,000	25,000	25,000	25,000
Law enforcement	0				
Information - education - outreach	80,000	80,000	40,000	40,000	60,000
Visitor Centre	80,000	40,000	80,000	80,000	40,000
Travel - training	12,500	9,000	9,000	7,500	6,000
Projects	35,112	35,112	35,112	35,112	35,112
Other operational costs					
Production of tags and souvenirs					
Booking adj eg depreciation	82,275	53,911	65,205	56,701	43,726
TOTAL funding US\$	1,435,772	908,318	1,114,908	944,706	715,231
Increased budget requirements realistic vs updated 2014	640,304 80%	112,851 14%	579,499 108%	397,167 73%	233,915 49%

The estimated expenditure 2014 of Bonaire, St. Eustatius and Saba from Table 4.1C are compared to the income and expenditure of the previous three years (cf. Table 4.2).

Table 4.2: Income and expenditure 2011-2013 compared to estimated expenditure 2014 (source 1: audited financial statements, source 2: DCNA)

INCOME	BONAIRE				ST. EUSTATIUS				SABA			
	Estimate 2014 ²	2013 ¹	2012 ¹	2011 ²	Estimate 2014 ²	2013 ²	2012 ¹	2011 ¹	Estimate 2014 ²	2013 ²	2012 ¹	2011 ¹
Government subsidies		61,043	57,544	54,031		125,698	125,698	125,698		159,756	51,226	36,465
EZ operational support		0	0	0		0	57,273	45,976		incl. in above	102,426	0
Grants		108,918	97,564	78,360		24,554	33,244	34,136		219,552	101,814	36,859
Service / admission fees		1,233,456	1,201,513	1,096,504		24,796	37,629	37,530		87,659	100,576	116,218
Donations, souvenir sales		11,969	28,377	26,864		304,055	17,115	18,410		319,068	18,209	22,334
DCNA essential operational support		0	0	0		0	0	0		0	0	0
Other income		45,326	35,593	32,902		12,607	13,632	3,486		74,733	30,048	9,034
SUBTOTAL INCOME		1,460,712	1,420,591	1,288,661		491,711	284,591	265,236		860,768	404,299	220,910
BZK operational support ²		213,373	201,500	200,725		175,517	165,750	165,113		175,517	165,750	165,113
TOTAL INCOME		1,674,085	1,622,091	1,489,386		667,227	450,341	430,349		1,036,285	570,049	386,023
EXPENDITURE												
Staff												
Manager				0				0		36,201		42,811
Assistant manager				0				0		0		0
Administrator				0				0		20,863		24,651
Chief ranger				0				0		37,986		0
Rangers				0				0		66,444		27,795
Education officer				0				0		20,782		22,504
Other staff				6,035				0		22,440		2,125
Other staff related costs				670,001				141,983		4,584		477
Total staff costs	805,000	840,940	815,111	676,036	510,000	210,346	169,142	141,983	615,000	209,300	202,281	120,363
Operational costs												
Administration	75,000	85,275	45,737	50,092	50,000	50,067	44,915	35,288	75,000	0	24,028	25,734
Vehicle/s	90,590	78,880	64,940	63,727	30,197	19,478	8,151	6,099	60,393	18,942	8,933	0
Boat/s	45,295	54,995	51,528	58,418	30,197	9,747	539	873	30,197	8,411	8,713	5,655
Maintenance - infrastructure	80,000	1,745	1,784	0	80,000	52	8,993	11,833	80,000	31,824	103,507	39,003
Monitoring - research	50,000	53,871	40,519	94,767.00	25,000	0	0	0	25,000	0	0	0
Law enforcement	80,000	0	0	0	40,000	0	0	0	40,000	0	0	0
Information - education - outreach	80,000	52,951	65,178	72,825	80,000	5,808	2,015	0	80,000	1,070	711	0
Visitor Centre	12,500	0	0	0	7,500	0	0	0	9,000	0	0	0
Travel - training	35,112	8,102	12,588	5,293	35,112	15,243	10,501	1,471	35,112	12,968	4,749	0
Projects		108,918	91,284	35,903		2,984	37,561	32,783		0	26,256	11,626
Other operational costs		35,428	56,277	35,350		16,714	878	1,033		297,623	7,111	4,320
Production of tags and souvenirs		45,767	41,460	48,055		0	0	16,081		0	0	0
Hyperbaric chamber maintenance		0	0	0		0	0	0		0	1,468	878
Depreciation / extraordinary results	82,275	111,419	129,364	94,558	56,701	0	31,769	106,814	65,205	0	39,254	29,920
SUBTOTAL EXPENDITURE	1,435,772	1,478,291	1,415,770	1,235,024	944,706	330,438	314,464	354,258	1,114,908	580,138	427,011	237,499
Donation to DCNA Trust Fund		213,373	201,500	200,725		175,517	165,750	165,113		175,517	165,750	165,113
TOTAL EXPENDITURE		1,691,664	1,617,270	1,435,749		505,954	480,214	519,371		755,655	592,761	402,612
RESULT		-17,579	4,821	53,637		161,273	-29,873	-89,022		280,630	-22,712	-16,589

Table 4.2 shows that the estimated expenditure 2014 for Bonaire is in line with the expenditure of STINAPA in the past three years (excluding the donation of the BZK operational support to the DCNA trust fund, an administrative arrangement), while for Saba the estimated expenditure of SCF has almost doubled and for St. Eustatius the estimated expenditure of STENAPA has almost tripled. This can largely be explained by the estimated increase in staff costs in 2014. The comparisons exclude the expenditure 'Donation to the DCNA trust fund'; this is an administrative arrangement to receive structural operational support from the Ministry of Foreign Affairs (income source 'BZK operational support'). The 7.5 million EUR which was allocated in 2013 to overdue maintenance of nature [*natuurgelden Caribisch Nederland*] are not a fixed source of income, but project funding and expected to be accounted for under 'grants'. This still needs to be verified with the park management organizations or its financial accounts of 2013. Another observation is that the government subsidies are lowest for STINAPA, both in absolute amount (slightly increasing from USD 54,031 in 2011 to USD 61,043 in 2013) and as percentage of the total income (4%), and highest for STENAPA, both the fixed annual amount (USD 125,698) and as percentage of the total income (26 to 48%).

On Saba the government subsidies have increased considerably in absolute numbers (from USD 36,465 in 2011 to USD 159,756 in 2013) due to the contribution of the Ministry of Economic Affairs (EZ) for the Saba Bank Management Unit since 2012, while the percentage of the total income remained around 17%. EZ also provided operational support to STENAPA in 2011 and 2012. The government subsidies for SCF in Table 4.2 do not include their in-kind provision of office and storage space.

Both STENAPA and SCF had negative results in 2011 and 2012, which turned into a positive result in 2013 due to private donation(s) of approximately USD 300,000 for each organization. STINAPA in contrast had a loss in 2013, but positive results in previous years.

The breakdown of expenses as provided by DCNA was not always easy to derive from the financial statements due to different or less specified cost categories in the financial statements; e.g. staff costs are not specified to functions; tags and souvenir costs are only specified in the STINAPA financial statement; costs of core management tasks such as monitoring and information and education are only specified in the STINAPA accounts; infrastructure is only specified in the SCF and STENAPA accounts and patrolling is not specified in any of the financial statements. Hence the breakdown of expenses is based on some assumptions, nevertheless, the total income and expenditure match the financial statements.

4.2 Potential sources of income

Besides the current income sources cf. Table 4.2, potential new sources of income to achieve financial sustainability for the park management organizations were studied by Spergel (2005, 2014). The first study was a feasibility study of a protected area trust fund to fund park management organizations from the interest received (Spergel 2005) and led to the establishment of a trust fund, managed by DCNA; the latter study re-assessed the financial sustainability of nature parks in the Dutch Caribbean and recommended additional funding sources for park management organisations and the trust fund.

Spergel (2014) calculated that a trust fund capital of 33 million USD is required to ensure that the annual returns on the invested capital provide long-term financial sustainability for basic park management of one terrestrial and one marine park (on all islands except Aruba) plus the DCNA management expenses. This target capital of 33 million USD will be sufficient for the trust fund to generate around USD 2 million per year. This in turn will be enough to cover 100% of the previously calculated financial gap in carrying out basic management of the parks on all 5 islands (1.67 million USD per year) and the management expenses of DCNA (333.000 USD per year). This previously calculated financial gap refers to table 9 in the report of the previous study of Spergel (2005), cf. Table 4.3. The gap is the difference between the available budget in 2002 (2.142.000 NAF) and the basic budget requirements of the 5 islands (5 million minus 350.000 for DCNA management is 4.650.000 NAF), resulting in a gap of 2.508.000 NAF (1.128.600 EUR) which is approximately 1.67 million USD.

Table 4.3: Basic park management needs to be covered by the 33 million USD trust fund (from Spergel 2014, pg. 38)

Basic budget requirements and actually available budgets in 1998 and 2002, for managing one marine and one land park per island (in NAF; 1 NAF = 0,45 Euro).

	Saba	Statia	St Maarten ¹¹	Bonaire	Curaçao	DCNA	TOTAL
Bare minimum ¹² budget requirements	385.000	385.000	250.000	475.000	475.000	250.000	2.220.000
Additional ¹³ basic budget requirements	425.000	425.000	560.000	635.000	635.000	100.000	2.780.000
Total basic budget requirements	810.000	810.000	810.000	1.110.000	1.110.000	350.000	5.000.000
Available budget 1998	530.000	271.000	199.000	564.000	673.000	-	2.237.000
Available budget 2002	323.000	135.000	169.000	865.000	650.000		2.142.000

With a trust fund capital of USD 13 million, the study of Spergel (2014) revealed a financial gap in the trust fund capital of 20 million USD. He suggested that additional sources of income to fund this gap could be a contribution by the Dutch ministry of Economic Affairs (EZ), or a 1 to 1 matching contribution by the ministry of EZ and the island governments through an earmarked grant for their particular island. Besides government subsidies also tax measures were suggested to fund the financial gap: introduction of an eco-tax or environmental impact fee for oil terminals and oil tankers based on the polluter pays principle; exemption of import duties on imported fixed assets (i.e. cars, computers) purchased by the nature organizations; cruise tourism environmental impact or nature conservation fee in addition to the existing passenger tax going to general government revenues; hotel tourism nature conservation fee similar to the 1 USD trail fee on Saba and the 9% hotel room tax on Aruba; and increase of park entry fees based on the high Willingness To Pay by visitors as the recent TEEB studies revealed (Spergel 2014).

Spergel gives two alternative solutions to deal with the financial gap in the trust fund capital: 1) the first option is to convert the current endowment into a 25-year sinking fund ¹. This enables DCNA to withdraw approximately 1 million USD annually during the next 25 years, and disburse approximately 800.000 to 850.000 USD per year as grants to the park management organizations; 2) the second option is to raise the endowment trust fund capital to 16.67 million USD and generate 1 million USD per year, which is a more sustainable solution than spending down a sinking trust fund capital to a zero balance. In the second option the financial gap of the trust fund is reduced to around 3 million USD, but

¹ Endowment fund is a trust fund where only the returns on invested capital, not the capital itself, may be used.

Sinking fund is a trust fund where investment income as well as the capital itself can be used over a fixed period

Revolving fund is a trust fund which is replenished by regular revenue sources such as fees or taxes.

the grant of 800.000 to 850.000 USD to fund all five park management organizations may not be sufficient to fill all their financial needs. The previously calculated financial gap of 1.67 million USD may however not be accurate anymore, based on current annual budget requirements.

4.3 Financial gaps

4.3.1 Different calculations of annual budget requirements

After having estimated the annual budget requirements in chapter 3 we compared these results of the activity based approach with the estimations of DCNA (cf. Table 4.4)

Table 4.4 Estimated annual budget requirements per island according to this study (blue) and DCNA (green). In red actual expenses in 2013 (Ernst & Young 2013), with the expenses including projects in parenthesis.

Resp. no.	Responsibilities	Task no.	Tasks	BUDGET REQUIREMENTS PER ISLAND			BUDGET REQUIREMENTS PER ISLAND			
				Total costs	Total costs	Total costs	Total costs	Total costs	Total costs	Total costs
				Bonaire	Statia	Saba	Bonaire	Statia	Saba	
1	Infrastructure:		Installation, periodic inspection and maintenance of infrastructure within protected areas							
		1.1	Trails	126,197	55,048	50,609	no spec.	no spec.	no spec.	
		1.2	Roads	177,078	-	-	no spec.	no spec.	no spec.	
		1.3	Paved area	4,097	300	600	no spec.	no spec.	no spec.	
		1.4	Buildings	74,910	17,873	17,085	no spec.	no spec.	no spec.	
		1.5	Signage	8,081	3,103	2,237	no spec.	no spec.	no spec.	
		1.6	Demarkation boundaries	13,669	-	-	no spec.	no spec.	no spec.	
		1.7	Marine structures: moorings, pi	25,008	8,544	12,135	no spec.	no spec.	no spec.	
		1.8	Freshwater structures: wells, d	798	33	-	no spec.	no spec.	no spec.	
		1.9	Other terrestrial structures	1,227	-	-	no spec.	no spec.	no spec.	
				431,063	84,902	82,666	80,000	80,000	80,000	excl. staff
2	Public awareness and education:		Provide information about protected areas to visitors, outreach to the public, education for children and stakeholder engagement							
		2.1	Information to protected area l	99,687	66,437	67,269	no spec.	no spec.	no spec.	
		2.2	Outreach to the public at large	14,193	14,193	16,736	no spec.	no spec.	no spec.	
		2.3	Education programmes to youn	49,289	27,383	14,865	no spec.	no spec.	no spec.	
		2.4	Stakeholder advice and involve	8,613	8,613	8,613	no spec.	no spec.	no spec.	
		2.5	Maintain media relations	2,850	2,850	2,850	no spec.	no spec.	no spec.	
				174,632	119,476	110,333	160,000	120,000	120,000	excl. staff
3	Monitoring and research:		Basic biodiversity and socio economic monitoring of the protected areas							
		3.1	Ecological monitoring on priori	46,151	46,151	71,801	no spec.	no spec.	no spec.	
		3.2	Pest control of invasive species	123,512	53,176	23,232	no spec.	no spec.	no spec.	
		3.3	Habitat/species restoration	123,512	53,176	76,752	no spec.	no spec.	no spec.	
		3.4	Abiotic monitoring	2,230	2,230	2,230	no spec.	no spec.	no spec.	
		3.5	Socio economic monitoring	855	855	855	no spec.	no spec.	no spec.	
		3.6	Research programmes	23,451	23,451	23,451	no spec.	no spec.	no spec.	
				319,711	179,040	198,321	50,000	25,000	25,000	excl. staff
4	Patrolling and enforcement:		Presence within protected areas to provide information and assistance and respond to user safety and law enforcement issues							
		4.1	Patrol protected areas	83,599	36,709	16,746	no spec.	no spec.	no spec.	
		4.2	Enforce user fees, user permits	6,039	6,039	6,039	no spec.	no spec.	no spec.	
				89,639	42,748	22,785	-	-	-	excl. staff
5	Equipment:		Provision and periodic inspection and maintenance of park equipment							
		5.1	Cars	111,520	34,314	31,114	90,590	30,197	60,393	
		5.2	Boats	49,399	25,279	25,279	45,295	30,197	30,197	
		5.3	Other equipment	12,764	8,594	8,138	no spec.	no spec.	no spec.	
				173,683	68,187	64,531	135,885	60,394	90,590	excl. staff
6	Finance and administration:									
		6.1	Accounting	31,675	15,838	15,838	no spec.	no spec.	no spec.	
		6.2	Administration	42,932	22,738	22,738	no spec.	no spec.	no spec.	
		6.3	Fundraising	5,049	5,049	5,049	no spec.	no spec.	no spec.	
				79,656	43,624	43,624	75,000	50,000	75,000	excl. staff
7	Management:		Overall management of the park management organization							
		7.1	Planning	6,062	6,062	6,062	no spec.	no spec.	no spec.	
		7.2	Coordination	39,936	39,936	39,936	no spec.	no spec.	no spec.	
		7.3	Staff management	68,631	35,577	37,850	no spec.	no spec.	no spec.	
		7.4	Fundraising	9,093	9,093	9,093	no spec.	no spec.	no spec.	
		7.5	Reporting	8,579	8,579	8,579	no spec.	no spec.	no spec.	
				132,301	99,247	101,521	-	-	-	excl. staff
			Subtotal core activity costs	1,400,686	637,224	623,780				
			Subtotal overhead costs	61,000	31,600	45,100	805,000	510,000	615,000	staff
				1,461,686	668,824	668,880	12,500	7,500	9,000	travel/training
							82,275	56,701	65,205	depreciation
							35,112	35,112	35,112	projects
							1,435,772	944,707	1,114,907	DCNA estimate 2014
							1,404,795	330,438	580,138	Actual expenses 2013
							(1,478,291)			

What appears from the above comparison is that the budget requirements of STINAPA (USD 1,461,000 or USD 1,373,000 excluding one-time investment in overdue mangrove maintenance) as assessed by the current study are not deviating a lot from the estimates of DCNA (USD 1,435,000). In contrast, the differences in budget requirements according to DCNA and this study are almost twice as much for SCF (USD 1,115,000 versus USD 669,000) and half as much for STENAPA (USD 945,000 versus USD 669,000).

The exact reason for the big gap between the estimation of DCNA and this study is a bit like comparing apples and oranges, because DCNA includes staff costs as a total and this study includes staff costs per activity. This explains why the subtotals per core responsibility/task are lower in the DCNA estimations, as these subtotals exclude staff costs. However, proportionally the DCNA estimations are often in line with our study, e.g. task 2: public awareness and education is estimated for STINAPA, STENAPA and SCF at 160,000/120,000/120,000 respectively, and we estimated 175,000/119,000/110,000 respectively. Also for task 3: monitoring and research is proportionally the same (factor 2/1/1 for STINAPA/STENAPA/SCF respectively) and task 5: finance and administration the required budget estimates do not deviate much either.

For core tasks 4: patrolling and task 7: management no comparison can be made. For core task 1: infrastructure the difference between STINAPA, STENAPA and SCF is very marked in our calculation, while it is the same amount for all three according to DCNA. The difference can be largely explained by road placement and maintenance (activity 1.2: USD 177,000) and overdue mangrove maintenance (activity 1.1.5 and 1.1.6: USD 88,000). The overdue mangrove maintenance is a one-time investment cost. The road maintenance is an annual depreciation cost, based on 95% dirt road and 5% paved road of the 42 km road in Washington Slagbaai. These costs will increase drastically if more roads are going to be paved: the action plan suggests 30% of the roads (12.6 km) in Washington Slagbaai are (going to be) paved (STINAPA 2015), we are awaiting confirmation if this is correct (J. Afman, pers. comm.). We estimated the current paved roads at 2 km length, plus paved labadó's, adding up to 2.1 km. We agree that the quality of the roads can be greatly improved, however, the investment costs of an additional 10.5 km road will be approximately USD 12 million (Martijn Zwiers, pers. comm.) For core task 5: equipment it seems likely that DCNA included investments here, while we estimated on the basis of depreciation (DCNA has included depreciation as a separate cost).

Concluding we advise to discuss with DCNA why they have estimated double as much expenses for SCF. Possible explanations are the planned expansion of the terrestrial national park of Saba and expansion of activities on the Saba Bank.

4.3.2 *Financial gap of STINAPA, STENAPA and SCF*

There is no appreciable financial gap between the estimated budget requirements of STINAPA (USD 1,461,000 or USD 1,373,000 excluding one-time investment in overdue mangrove maintenance) and their actual expenses (USD 1,404,000 in 2013, cf. table 4.4) and actual income in the past two years (USD 1,460,000 in 2013 and USD 1,420,000 in 2012, cf. table 4.3). There may be a small gap of USD 40,000 to completely finance the overdue mangrove maintenance of USD 88,000 (and invest in more paved roads), if the increase in income in 2013 is not sustained in 2014.

There is a financial gap on St. Eustatius and Saba. STENAPA, according to our estimates, has a financial gap of USD 340,000 (USD 669,000 versus USD 330,000 actual expenditure, cf. table 4.4). This can be explained easily, because STENAPA marine park is as large as the STINAPA marine park (27 km²) and although the terrestrial park (5.5 km²) is a factor 10 smaller than the STINAPA terrestrial park (60 km²), STENAPA has always lagged behind in income and expenditure in comparison to the other islands and has faced a number of almost bankruptcies. The financial gap of USD 340,000 may be as high as USD 470,000 (USD 669,000 versus USD 200,000 sustainable income), because the actual income in 2013 was exceptionally high due to a donation of around USD 300,000 (cf. table 4.3).

Sustainable income sources of STENAPA in the past three years were only around USD 200,000 (excluding EZ support of 46,000 and 57,000 in 2011 and 2012 respectively, cf. table 4.3).

SCF has a smaller financial gap of USD 90,000 according to our estimates (USD 669,000 versus USD 580,000 actual expenditure, cf. table 4.4). However, sustainable income sources of SCF in the past three years were only around USD 300,000 (excluding EZ support since 2012 for the Saba Bank Management Unit, approx. USD 100,000). Like STENAPA, the income of SCF in 2013 was also exceptionally high due to a donation of around USD 300,000, so the financial gap to be bridged is more likely to be USD 370,000.

The annual financial gap of STENAPA and SCF adds up to USD 840,000, or USD 740,000 (STENAPA: 470,000; SCF: 270,000) when deducting the USD 100,000 EZ support for the Saba Bank Management Unit as a sustainable income source.

4.3.3 Financial gap of the DCNA trust fund

For the financial sustainability of nature parks in The Dutch Caribbean it seems undesirable to change the endowment trust fund into a 25-year sinking fund, resulting in a zero balance after 25 years without sustainable income for the park management organizations.

The financial gap of the current trust fund is at least 3 million, to raise the endowment trust fund capital to 16.67 million USD and generate returns on investments of 1 million USD per year, of which 800.000 to 850.000 USD should be used to fund five park management organizations. This is barely sufficient to cover the annual financial gap of STENAPA and SCF, and leaves 50.000 to 100.000 USD to fund the gaps of nature parks on Curaçao and St. Maarten.

5. Discussion

Worldwide, financial needs for biodiversity conservation to protect threatened species and their essential habitats are not met, e.g. only 12 percent of the conservation costs for globally threatened bird species is covered. The investment in biodiversity conservation to effectively protect species and areas needs to increase by one order of magnitude, especially since there is growing evidence of the effectiveness of conservation spending (McCarthy et al. 2012).

McKinney (2002) found that per capita conservation spending correlates strongly with per capita income: $\text{Spending per acre} = 1.2 \text{ population density} + 0.92 \text{ GDP}$. In China nature reserve spending has increased by a factor of 2.3 between 1995 and 2005 and currently amounts to 5.5 USD/ha (Li et al. 2013). Conservation spending in the USA amounted to 1.2 percent of the federal government spending up to 1997, but decreased to 0.6 percent of the federal budget, even though biodiversity conservation generates about 3 million jobs in the USA and even though the US national parks and wildlife refuges generate 25 billion in economic activity, support an outdoor industry valued at 6 million jobs, 730 billion in economic activity and 49 billion in government tax (NWF 2014). Southwick and Associates (2013) show that at present in the USA 38.8 billion in direct nature conservation spending generates 93.2 billion in economic activity, of which 12.9 billion flow back to government in the form of taxes. Hence, nature conservation spending has a favourable multiplying factor.

Young et al. (2012) indicate that the trend towards decreased government involvement in conservation and greater reliance on public participation undermines conservation effectiveness. Without an informed debate, participatory approaches can undermine structural gains. Hein et al. (2013) stress the need for biodiversity conservation to base itself on a broader series of funding sources and highlight as an example the potential of the Payment for Ecosystem Services (PES). Bhat (2014) emphasizes the potential of user-based financing for atoll conservation in the Maldives.

Understandably, in regions where tourism and environment are important to the local economy, local government spending is often higher than the contribution of the federal government (Wang and Berman 2014). However, the actual spending by the local government of Bonaire compared to the Dutch government lags greatly behind. Local government funding of nature conservation in Florida has grown more stable and secure in recent years (Wang and Berman 2014). In their analysis of Upper-Middle-Income tropical countries (a category which Bonaire belongs to), Vincent et al. (2014) showed that governmental protective conservation measures, which were implemented to help stimulate economic development, have lagged behind compared to citizen awareness and public demand for measures.

Evaluating the effectiveness and efficiency of conservation spending is essential (Laycock et al. 2011). Of 38 species action plans studied by Laycock et al (2011) the five most expensive programs accounted for 80% of the funding, 50% had improved the conservation status of the species and 33% had reduced threats. Due to funding limitations, strategic use of available funds is all the more important.

In contrast, spending for information, awareness raising, outreach, and education is crucial and has a long term positive effect. For example, the Quill management plan states: "The perception amongst some local people is that the national park is about stopping you doing things (like hunting or taking sand). However, most people admitted this had been a big issue in the early days of STENAPA but now most local people were more accepting. "These issues of orchid harvesting, littering and hunting need sensitive dealing with". "Our relationship with STENAPA has got better over the years". "Some local people don't like the restrictions, but I recognise its management for the long term" (MacRae et al. 2009, p.98).

Monitoring

A nature management park's main priority is nature and biodiversity conservation and protection. Hence, monitoring and research should not be overemphasized. The STENAPA management plan of 2009 also states "that STENAPA does not attach too much importance to the scientific and technical aspects of managing the natural environment, at the expense of the human, cultural, and spiritual aspects.", explaining that "with few staff STENAPA can't do everything" (MacRae et al. 2009, p.97). However, the management plan lists activities that are in contrast to this conception, and they should therefore be reviewed:

- Collect base line information on status of historical/biological resources; establish links to academic institutions that could have a longer term relationship. More science and evidence based work.
- Reduce the number of surveys and projects being carried out at any one time. Specialists must be called in to look at historical sites and artefacts when necessary.
- We have good researchers. STENAPA could do with more biological inventories especially birds and insects. It would be preferable to have people from this region carry out the work (though it is acknowledged there isn't really expertise, even in the University of the West Indies).
- Develop the potential for collecting local stories and knowledge – a kind of oral history recording project.

Given the park management priorities for nature protection, monitoring normally forms a small part of allocated funding and personnel time in park management organizations. For instance, in 2008 the National Park Service of the USA, which manages 270 national parks nation-wide, dedicated 9.8 million (NPS 2009) of its total budget allocation of 2363.8 million USD (NPS 2008) (ie. 0.4%) to the monitoring task. Of these allocated funds, 80% were dedicated to baseline inventories, 5% to recurrent monitoring and 15% to IT personnel and expertise. Based on this funding level, it was calculated that it would take 10-12 years to complete the baseline inventories required for all parks. Clearly, for meaningful monitoring in the national park system of the USA, the Park Service relies on cooperation with partner NGOs, agencies and universities, leverage, volunteers and on "citizen science" (Casanovas et al. 2014), which form key elements of their funding strategy for monitoring (NPS 2009).

In the Netherlands, park management organizations generally spend more of the annual budget allocation towards monitoring than in the USA. For instance, the organization '*It Fryske Gea*' (IFG), which manages 58 different conservation areas covering a total of 20,000 ha throughout the province of Friesland, budgets roughly 5% of their annual exploitation expenditures of 6 million Euro on monitoring and inventories (i.e. approx. 300,000 Euros; A. Wester, pers. comm.). The same holds for other large park organizations such as '*Stichting Landschap Overijssel*' (SLO) in the Netherlands, an organization with a total annual turnover of about 11.7 million Euros and 44 full time personnel equivalents (SLO 2014) that (in addition to serving an advisory role) manages 50 conservation areas in the Overijssel province for a 1.1 million portion of the total budget. Of that, 45,000 Euros are dedicated to biological monitoring by the *Subsidiestelsel Natuur en Landschap* (J. Van der Weele, pers. comm.). Hence, about 6% of total budget expenditures are dedicated to this task.

Overall, density of natural history and monitoring data per conservation area in the Netherlands are high, but this is largely thanks to volunteer networks, natural science working groups, flying brigades and organized amateur biologists and birders. Important groups include organizations such as the KNNV (Netherlands Association for Field Biology), RAVON (Reptile and Amphibians Research), SOVON (Bird Research) and FLORON (Plant Research), just to name some of the larger natural history networks.

Patrolling

The old-fashioned punitive and controlling game warden with focus on enforcement practically no longer exist in the Netherlands. Today for the 50 conservation areas managed by Landschap Overijssel, game wardens are strictly volunteers and are referred to as "*gastheren*" or "nature hosts" (G. Pastink, pers. comm.). The focus is on interaction, information provision and no longer on control and issuing fines. With respect to enforcement they largely only serve as eyes and ears for the police. In the SLO, participation in field monitoring is used as a means to ensure "surveillance presence" of staff in the managed conservation areas (J. van der Wee, pers. comm.).

It Fryske Gea currently has no staff or patrols specifically active for enforcement purposes. With a total staff of 63 fulltime workers (IFG 2014) it does have 8-9 staff members and one volunteer who are special agent of the police (*BOA: Buitengewoon Opsporings Ambtenaar*). To be effective, enforcement and surveillance must be a fulltime activity, however, for many years IFG has had no active full-time BOA (A. Wester, pers. comm.). Illegal fishing and persecution of birds of prey remain persistent problems. In many areas wildlife disturbance caused by lack of compliance to leash dogs remains very serious and poorly enforced (A. Wester, pers. comm.). In 2015 IFG has planned to have two fulltime staff to patrol and enforce rules and regulations in their protected areas. For the IFG, the public and many volunteer groups (numbering about 400 province-wide), and the various bird working groups [*vogelwerkgroepen*] in fact act as the eyes and ears for enforcement (A. Wester, pers. comm.). The IFG BOAs are authorized to instruct, reprimand and arrest, but to detain for further prosecution, the national police need to be called in. In the province of Friesland, all nature surveillance interests join forces in the *Natuur Toezichtskring* (Nature Surveillance Circle) as led by the national police (LOM 2010). IFG is one of several structural members of this network (LOM, 2010). As of 2014, all surveillance and enforcement activity across the blue (water) green (terrestrial nature), and grey (urban) sectors will be coordinated and shared under the FUMO (*Friese Uitvoeringsdienst Milieu en Omgeving*).

To a large extent this change reflects development in technology and awareness, in combination with funding cutbacks and heightened training requirements. Because of increased awareness of the public visiting conservation areas and the availability of cellular telephones, the visiting public has gradually developed a much more active role in such areas as monitoring and safety and also serves effectively as the eyes and ears and early warning system for enforcement. With large changes in the economy, culture and attitudes towards nature, hunting and animal welfare, as have taken place, the extent of illegal or potentially illegal activity by the visiting public that can be harmful to nature has declined in the Netherlands as well as in the Dutch Caribbean (EZ, 2014). Finally, in the Netherlands the legal training requirements for wardens to actually function as special agents of the police (BOA) have become very high and costly. In the Netherlands at present, BOAs are obligated to follow 5-8 days of trainings per year to be able to maintain their special police status. This makes it very difficult to continue to find volunteers willing to serve this enforcement function (G. Pastink, pers. comm.). Consequently, the KNVN (*Koninklijk Nederlandse Vereniging voor Natuurtoezicht*) (Royal Netherlands Association for Nature Supervision), the main organization in the Netherlands providing nature enforcement and surveillance nationwide and all based on volunteers, has seen a steady decline in willingness among its volunteers to maintain their BOA status for enforcement.

In conclusion of this section, and with the Netherlands as an example, we see that major developments in technology, community awareness, legal requirements and funding availability have brought major changes in the role and actual implementation of surveillance and enforcement for nature. The need, objectives, and implementation form for surveillance and enforcement have changed greatly and declined significantly in recent decades, and raise the question on how much of the finances and personnel of park management in the Caribbean Netherlands actually needs to be dedicated to this task in a balanced allocation of limited funds.

Modern developments of technology, and awareness in combination with growing legal and financial constraints mean that surveillance and enforcement are more and more based on cooperative networks of organizations to share and divide the burden so as to limit costs, and overlap and maximize effectiveness. For this, effective collaboration is paramount.

6. Conclusion and recommendations

The primary goal of nature conservation is protection and preservation of nature. Core responsibilities to achieve this are: 1) provisioning of infrastructure, 2) raising public awareness and education, 3) monitoring and research, and 4) patrolling and enforcement. The other responsibilities are supporting these four core responsibilities, yet they still are essential to achieve the primary goal: 5) providing sufficient equipment, 6) funding, finances and administration of the operations, and 7) management including planning, coordination and reporting.

Our assignment was to identify the budget requirements of park management organizations on Bonaire, St. Eustatius and Saba and to identify the financial gap between budget requirements and income sources. We built on the previous studies done by MINA and DCNA in 2000 (MINA), 2005 (Spergel) and 2014 (Spergel and Appendix A) to define core management tasks. Rather than the functional approach of these studies which quantified budget needs based on staffing of the park management organizations, we introduce an activity-based approach to identify budget requirements. We used elements of the Netherlands cost standards approach for nature management to calculate the budget requirements.

DCNA and park management organizations were in the process of identifying core management tasks simultaneously with this study. We received their preliminary list in November 2014 and used it as the basis for our assignment. We deviated from their list in a few ways:

- a) We re-arranged the list in 3 levels (responsibilities-tasks-activities), prioritized the four most important responsibilities to achieve nature conservation (infrastructure, education, monitoring, enforcement)
- b) We merged tasks which we considered similar (e.g. monitoring and research) and subdivided tasks in several activities.
- c) We introduced an activity-based approach to identify budget requirements rather than a functional approach.

DCNA made a distinction between basic tasks and recommended tasks. The distinction made years ago in the study of MINA (2000) were: basic budget, minimal budget and emergency budget to prevent STENAPA and St. Maarten Nature Foundation from bankruptcy. We included all basic tasks identified by DCNA in our list, and most recommended tasks, but also added a number of tasks:

- habitat and species restoration: restoration from losses or damage to habitats and species is part of the primary goal of nature conservation. Nature needs to be protected against two principal global threats to biodiversity: invasive species and habitat loss and destruction. Unfortunately these critical tasks are often lost sight of and presently only play a minor role in day to day management. These critical tasks therefore, need to be consciously apportioned time and budget in the management program.
- abiotic monitoring: trends in abundance or distribution of key species or systems over time may be caused by a number of factors. To be able to understand why changes in fauna and flora are or are not taking place, it is essential to do a minimum of monitoring of abiotic factors that influence species abundance and distribution. Collecting a time series of rainfall, seawater temperature, current velocity and direction, salinity, water quality, water depth in salina's at key sites, etc. can greatly enhance ecosystem understanding for management purposes.

We also emphasize the importance of installation, periodic inspection and maintenance of infrastructure to preserve and protect nature. Maintenance of trails, roads, moorings and demarcation boundaries is mentioned by DCNA, but we recommend highlighting a number of infrastructure components which are essential but which were not explicitly mentioned:

- Fences, grids and corrals: demarcation of protected areas to keep livestock out and animals in is essential to protect sensitive habitats and structures. This includes placing livestock grids and livestock corrals and fencing protected area and fresh water structures for example.
- Freshwater structures: although only applicable on Bonaire there are a number of modern and ancient wells and pos di pia which are essential as water supply for flora and fauna.
- Mangrove forest: routine maintenance and lateral trimming of the mangroves trees in channels in Ramsar site Lac Bonaire is essential to keep the mangrove channels open.

The tasks on the list of DCNA which we do not recommend to incorporate as core park management tasks are:

- International outreach and representation: we consider this primarily a DCNA responsibility. Park managers who are part of the board of DCNA can of course be asked to give presentations and join meetings or debates. We consider participation in (sub)regional activities a legitimate and important part of nature management when joint, larger scale programs require cooperation in regional projects;
- Regional and international media strategy: we consider this a DCNA responsibility, as their experience and network is the strength of DCNA and it is better to join forces at regional and global level and benefit from the larger scale of operations;
- Membership/sponsorship/appreciation/donor programme: we consider this a DCNA responsibility as well, as this is part of the responsibilities of the trust fund management. The park management organizations can benefit from programs developed through the experience, network and scale of operations of DCNA. Local fundraising and membership programs related to island specific features and issues may currently be necessary to cover financial needs. Once the funding gaps have been addressed, the need for additional fundraising becomes less important, while the need to create a personal link with visitors may become more important.
- Application of grants exceeding USD 50.000: we consider this primarily a DCNA responsibility to actively pursue big grants, like was done in 2014 for the National Postcode Lottery grant for shark conservation. Of course, park management organizations should provide input from their island perspective and be keen on funding opportunities if they arise, however the focus should be on implementation of park management tasks.
- Advanced training (e.g. dive certification, vocational training, academic programs): we see this as an opportunity to use as fundraising tool (summer school, paid volunteer programs), as the costs need not exceed the income if properly organized, and do not consider this an actual budget requirement;
- In-house souvenir shop with complete inventory: souvenirs are nice merchandize and free advertisement, however we mainly see it as a fundraising tool which does not require additional budget, as, if properly organized, the income should exceed costs.
- Monitoring and research: we recommend that monitoring and research should focus on collecting essential management data and collaborating with research institutes.

The annual budget requirements of the core tasks for Bonaire, Saba and St. Eustatius are presented in table 3.1: approx. USD 1,461,000 for STINAPA (including an investment of USD 88,000), USD 669,000 for STENAPA and also USD 669,000 for SCF. The precise calculation of the budget requirements – specified at activity level – can be found in Appendix B.

In chapter 4.3 we identified three 'financial gaps': 1) the difference in annual budget requirements according to this study and according to the realistic budget estimations we received from DCNA; 2) the difference between the annual budget requirements according to this study and the actual expenses and sustainable income sources; and 3) the financial gap in the DCNA trust fund to start generating returns on investment.

As for the latter financial gap, this is at least 3 million, to raise the endowment trust fund capital to 16.67 million USD and generate returns on investments of 1 million USD per year, of which 800.000 to 850.000 USD should be used to fund five park management organizations. This is barely sufficient to cover the annual financial gap of STENAPA and SCF (see point 2), and leaves only 50.000 to 100.000 USD to fund the financial gaps of nature parks on Curaçao and St. Maarten.

With regards to the first gap, there are substantial deviations in the estimates for STENAPA and SCF only. It requires further study with DCNA (and the park management organizations) to find out why the estimated expenditures are approximately half as much more.

There are financial gaps for SCF and STENAPA between the estimated budget requirements and the actual expenses. When taking into account the sustainability of the actual income the annual financial gap of STENAPA and SCF adds up to USD 740,000 (STENAPA: 470,000; SCF: 270,000) after deducting the USD 100,000 EZ support for the Saba Bank Management Unit as a sustainable income source.

There is a minor financial gap between the estimated budget requirements of STINAPA (Bonaire) and the actual expenses and actual income in the past two years. There may be a small gap of USD 40,000 to finance the overdue mangrove maintenance of USD 88,000 (and invest in more paved roads), if the increase in income in 2013 is not sustained in 2014.

We recommend parties to use the task-based calculation model as designed in this study for future management and fundraising purposes and to plan and justify the activities and budget requirements of the park management organizations. However, the price, cost and activity assumptions made in our calculation model should be validated by a third party and/or by the park management organizations e.g. through a workshop and regularly updated. We also recommend a sensitivity analysis of minimum and maximum amounts for different scenarios to be included in the calculation model. Furthermore the calculation model is generally applicable and can also be used and adapted to estimate the budget requirements of park management organizations on Curaçao and St. Maarten, and to calculate the appropriate level of the trust fund capital needed to ensure financial sustainability for nature management for the five participating islands.

7. Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 124296-2012-AQ-NLD-RvA). This certificate is valid until 15 December 2015. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Fish Division has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2017 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

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Saba Conservation Foundation (SCF): Kai Wulf (marine park manager)

Dutch Caribbean Nature Alliance (DCNA) Bonaire: Kalli de Meyer (executive director)

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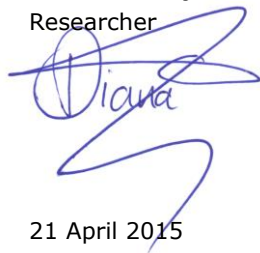
9. Justification

Report: C033/15
Project Number: 4308201141

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Dr. D.M.E. Slijkerman
Researcher

Signature:

A handwritten signature in blue ink, appearing to read 'Diana', with a large, stylized flourish below it.

Date: 21 April 2015

Approved: Drs. F.C. Groenendijk
Head of Maritime Department

Signature:

A handwritten signature in blue ink, consisting of a large, stylized initial 'F' followed by a long, sweeping horizontal line.

Date: 21 April 2015

Appendix A: Management tasks identified by DCNA and Park Management Organizations

		BASIC	RECOMMENDED	Basic	Recom mende d
Administration					
	Planning: action plans/budgets	Planning; development of Annual action plans and budgets for each protected area		x	x
	Governance	Providing secretariat function to park board: including meeting planning and execution, agendas and meeting minutes for Board +/- Committees		x	x
	Administration	Daily office tasks including logistical organisation, agenda organisation, mail processing, filing, correspondence, travel logistics, invoicing and payments		x	x
	Bookkeeping	Accurate cash based recording of income and expenditure, including income from fees	Accrual based accounting including deferred income for projects	x	x
	Accounting		Appropriate processing and registration of income and expenditure and associated documentation to allow production of Financial Statement		x
	Staff management	Personnel administration - contracts - job descriptions - policy manual - payroll - staff development and training		x	x
	Financial Statement		Production of annual financial statement		x
	Annual audit		Preparation of audit documentation (such as PBC list) and on site audit management		x
	Periodic reporting	Basic financial and technical reporting using prepared template		x	x

	Annual Report	Production of annual technical report, financial report and updates on park activities and achievements	Production of an Annual Report with an overview of achievements, activities, balance sheet and statement profit and loss		x
Field administration and maintenance					
	Field logs	Keeping records of patrols		x	x
	Patrolling	Providing an on-going presence within protected areas including the ability to provide information and assistance and respond to user safety and law enforcement issues	Collect information on user activities	x	x
	Buildings	Periodic inspection and maintenance of buildings, offices, storage areas, visitor centre, museum etc, vehicles, boats		x	x
	Transportation	Periodic inspection and servicing of vehicles, boats	Maintenance of vehicles and boats beyond period servicing, but not including repairs	x	x
	Infrastructure	Periodic inspection of infrastructure within the protected area including roads, tracks, trails (per km). Basic maintenance such as trail repair, cutting new trails, assisting with road maintenance. Maintaining demarcation boundaries such as navigation buoys.	Creating trail system, developing new snorkel trail, bird trail or similar including trail, safety considerations and signage	x	x
	Moorings	Periodic inspection and maintenance of moorings within the protected area moorings (per mooring) including replacement of ropes, buoys etc	Provision of new moorings, replacement of old moorings involving the use of drilling equipment or underwater lifting apparatus, placement of markers or similar	x	x
	Equipment	Periodic inspection and maintenance of markers such as trail and marine markers, buoys, essential signage, and specialized equipment (such as diving gear)		x	
	Signage	Periodic inspection and	Development and installation	x	x

		maintenance of essential signage	of signage		
Fundraising					
	Government subsidies	Administration and reporting to Government on subsidies		x	x
	Fees	Collection, financial administration and management (including reporting) of income from fees, concessions etc including user fees, mooring fees, fee for services and similar in order to give reasonable assurances of correctness		x	x
	Grants	Administration and management of grants funds including proposal writing, reporting, fund management	Application for third party funding in excess of USD 50,000	x	x
	Donations	Administration and management of physical and on line donations	Development of membership or major donor programme (including solicitation, welcome and engagement with donors, IT, acquisition and maintenance of tax exempt status and reporting)		x
	Souvenirs	Purchase and sale of souvenir items including purchasing and maintenance of inventory sufficient to give reasonable assurances of correctness	Running of in house facility for the sale of souvenirs or similar for the sale of souvenirs, complete inventory maintenance		x
Information - education - outreach - stakeholders					
	Representation	Park should represent itself and nature conservation activities and interests to the public at large on island and abroad: including giving presentations locally and providing information	Park should represent itself internationally at appropriate venues and to participate in international conservation debates in the region, give presentations, sit on Committees and similar	x	x
	Media	Maintaining media relations (press, radio, TV), including, providing material, giving interviews, organising and leading relevant fam trips, assisting media and TV	Developing a media 'voice' for nature conservation locally and regionally such as providing regular (international) news pieces and stories	x	x

		personnel in the field to portray an accurate and realistic picture of nature conservation			
	Outreach	Information provided to the public should include at least appropriate protected area signage (at entrance and sites of special value/concern/interest) and the provision of posters/leaflets and/or similar to inform users of park goals, rules and regulations.	Park interpretation services: such as provision of guides, guided tours, snorkelling and similar, running of museum information centre or other facilities open to the public	x	x
	Education	Education should include in and/ out of school programmes focused on the protected area, which ensure that all school age children receive instruction on nature/conservation management at least once in each school year	Provision of more than one contact per year with school children within an academic environment	x	x
	Out of school programmes	Provision of out of school activity programmes for school age children guided trails and activities in nature, snorkel clubs similar	Provision of Junior Ranger and/or vocational training opportunities for school age children, organisation of advanced training such as dive certification, contributions to summer camps, activity camps and similar	x	x
	Stakeholder engagement	Stakeholder involvement to include annual community meetings, annual meetings with businesses operation within protected area	Facilitate stakeholder participation in aspects of protected area management	x	x
Research					
	Research	Setting of research priorities to address management needs and (potential) threats to biodiversity within the protected areas, identifying suitable researchers/institutions, facilitating appropriate research programmes on site	Participating, initiating or implementing research programmes in whole or in part	x	x

		(e.g providing logistical support where possible)			
Monitoring					
	Biodiversity	Maintenance of baselevel inventories, ensuring the implementation of basic biodiversity monitoring such as ReefCheck of key ecosystems and/or species (land and sea) where priorities are based on management needs and priorities identified in the Biodiversity Strategy, submitting data to third parties for processing	Conducting baseline data collection, biodiversity monitoring beyond basic annual surveys, data processing, statistical analysis, reporting for key ecosystems and species (land and sea) where priorities are based on management needs and priorities identified in the Biodiversity Strategy, submitting data to third parties for processing	x	x
	Socio economic	Socio economic monitoring such as collection of visitor statistics, information on local use and visitor usage data	Livelihood studies, economic evaluations, user preference studies, carrying capacity, examination of Limits of Acceptable Change or similar	x	x
Law enforcement					
	Law enforcement	Reporting and interceding with illegal activities, providing information to users, issuing verbal/written warnings, responding to reports of incidents/infringements, notifying and assisting appropriate agencies (police, customs, coast guard), filing reports, attempt to stop illegal activities	Any law enforcement activity which requires "Buitengewoon opsporingsambtenaar" authority	x	x
	Legal enforcement		Filing reports of incidents, writing up prosecutions, issuing summons and on the spot fines		x
	Permitting	Providing advice regarding permits, policy, law, rules and regulations, assisting in the issuance of permit, exemptions and the enforcement thereof		x	x

Advice					
	Stakeholders/users	Providing information to users verbally and otherwise on issues related to local policy, legislation, permits, rules and regulations		x	x
	Decision makers	Representing protected area and relevant species conservation and ensuring concerns are included in government debates, providing advice to civil servants and government, asked for or otherwise, participating in commissions, platform meetings and similar		x	x

Appendix C: Staff costs

Generic salary costs of the staff functions in the park management organizations. Generic staff salary scales are calculated using a point scale and three salary levels, min-median-max salary. Salaries are assumed to include employer costs such as social insurances (source: a recent study commissioned by DCNA).

We used the median salary as annual gross salary costs. The hourly rate is the annual gross salary, divided by 52 weeks, divided by 40 hours, multiplied by 20% to cover overhead costs (e.g. holiday, vacation, illness, meeting, training).

Staff functions	Annual median salary	Hourly rate
general director	65,674	37.89
park manager	54,522	31.45
science director	66,913	38.60
administrative assistant	42,378	24.45
cashier	23,543	13.58
chief ranger/assistant manager	32,217	18.59
senior ranger	29,739	17.16
ranger	28,500	16.44
assistant ranger	24,783	14.30
communication officer	42,378	24.45
communication assistant	37,174	21.45
nature education officer	42,378	24.45
nature education assistant	38,413	22.16
research officer	43,370	25.02
cleaner	10,904	6.29
security guard	23,543	13.58
accountant	52,539	30.31
project officer *	43,370	25.02

* project officer was not included in the study, and assumed to be equal to a research officer

Appendix D: Equipment costs

Equipment list of commonly used equipment by park management organizations and the annual depreciation costs. Following general accounting principles the depreciation period is 5 years for most fixed assets and 3-10 years for transportation equipment (Ernst & Young 20122012a). Based on supplier information the lifespan of cars is at least 10 years (Source: Akkermans, Bonaire) and the lifespan of boats is 6000-8000 hrs, divided by 20 operating hours per week is almost 7 years (source: Bonaire Marine Center).

Sources of cost prices and maintenance costs are provided underneath the table and guesstimated for some fixed assets. Annual costs of fixed assets are the investment (cost price / depreciation years), the maintenance and the pier rental for the boats is also included as a fixed annual cost. Variable running costs (last column) are used in the calculation of the direct costs per unit of activity.

Equipment	Cost price (USD)	Depreciation (Yrs)	Annual costs (USD)			Rent pier marina Bonaire ³	Total units Bonaire	Total costs Bonaire	Total units Statia	Total costs Statia	Total units Saba	Total costs Saba	Running costs per unit (USD)	
			Investment	Maintenance	Total									
Vehicles														
4WD Toyota Landcruiser ¹	57000	10	5700	700	6400		13	83200	4	25600	3	19200	7	0.30
2WD Toyota Yaris ¹	20000	10	2000	500	2500		0	0	0	0	1	2500		0.15
golf cart	5000	10	500	50	550		0	0	0	0	1	550		0.00
boat 18ft 115HP + trailer ²	45000	7	6429	1500	7929	3942	2	23742	1	7929	1	7929		5.00
boat 28ft 2x150HP + trailer ²	70000	7	10000	3000	13000	6132	1	19132	1	13000	1	13000		10.00
								126074		46529		43179		
Field equipment														
chainsaw ⁴	269.99	5	54	0	54		2	108	2	108	2	108		
hammer drill wood/moekel (moker) ⁴	19.99	5	4	0	4		2	8	2	8	2	8		
bar straight/barete ⁴	39.99	5	8	0	8		2	16	2	16	2	16		
plier groove joint/playa ⁴	14.99	5	3	0	3		4	12	4	12	4	12		
jerrycan gas poly ⁴	14.99	5	3	0	3		16	48	6	18	7	21		
oil 2 cycle ⁴	2.99	5	1	0	1		16	16	6	6	7	7		
machette ⁴	14.99	5	3	0	3		10	30	10	30	10	30		
hoe blade eye/chapi ⁴	29.99	5	6	0	6		3	18	3	18	3	18		
handle hoe/palu di chapi (schoffel) ⁴	9.99	5	2	0	2		3	6	3	6	3	6		
pick mattock wood/piki ⁴	19.99	5	4	0	4		3	12	3	12	3	12		
shovel dhsp wood prm/skop ⁴	19.99	5	4	0	4		5	20	5	20	5	20		
glove men leather palm ⁴	4.99	5	1	0	1		10	10	10	10	10	10		
UW drilling/helical installation	500	5	100	0	100		0	0	0	0	1	100		
GPS	250	5	50	0	50		10	500	5	250	5	250		
lumpsum	5000	5	1000	0	1000		1	1000	1	1000	1	1000		
								1804		1514		1618		
Communication equipment														
VHF tranceiver ⁵	2400	5	480	0	480		1	480	1	480	1	480		
VHF handset ⁵	300	5	60	0	60		17	1020	10	600	10	600	8	
cell phones	200	5	40	0	40		10	400	5	200	5	200	8	
								1900		1280		1280		
Audio Visual equipment														
projector	200	5	40	0	40		1	40	1	40	1	40		
camera	200	5	40	0	40		1	40	1	40	1	40		
UW camera/video	500	5	100	0	100		1	100	1	100	1	100		
								180		180		180		
Staff equipment														
dive equipment	1500	5	300	100	400		7	2800	5	2000	5	2000		
staff uniform+backpack+shoes	500	5	100	0	100		17	1700	10	1000	10	1000	8	
								4500		3000		3000		
Office equipment														
PC	500	5	100	0	100		27	2700	15	1500	15	1500	8	
printer ⁶	300	5	60	50	110		3	330	2	220	1	110		
copier ⁶	500	5	100	100	200		3	600	2	400	1	200		
AC	1000	5	200	50	250		3	750	2	500	1	250		
								4380		2620		2060		
								138838		55123		51317		

1 Source: Akkermans Toyota Dealer, Bonaire

2 Source: Bonaire Marine Center

3 Source: Harbour Village, Bonaire www.harbourvillage.com/marina.html

4 Source: Kooyman, Bonaire

5 Source: www.handelsondernemingveenstra.nl

6 Source: www.xerox.com

7 The actual number of 4WD on Saba is 1, which we increased to 3, see Table 3.2 for explanation

8 The number of VHF and staff uniforms equal the number of rangers required. The number of cell phones equals the number of other staff, and the number of PCs equals the number of total staff (all cf Table 3.2)