



Research Article

Linking ecosystem services and the Sustainable Development Goals in Small Island Developing States: the case of Aruba

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Abstract

The economy and well-being in Small Island Developing States (SIDS) and other Subnational Island Jurisdictions (SNIJ) highly rely on marine and coastal ecosystem services (ESS). Moreover, SIDS and SNIJ share common challenges in achieving the Sustainable Development Goals (SDGs). Building a fact-based solution to demonstrate the link between ESS and SDGs is essential for nature conservation and sustainable development in SIDS and SNIJ. In this study, we developed a 5-step approach to capture the contribution of ESS to the achievement of SDGs in Aruba by means of a shortlist of indicators, with the aim to provide information for optimal policy investments to implement the Aruba 2030 roadmap. The results numerically and spatially demonstrate the contribution of fisheries, nature-based tourism and local cultural recreational ESS to achieve SDG targets 14.7 (increase SIDS' economic benefits from sustainable use of marine resources), 8.9 (devise and implement policies to promote sustainable tourism) and 3.4 (promote mental health and well-being); and how investing in these key ESS could lead

to multiplying co-benefits for other SDGs. This paper also discusses how the 5-step approach and the outcomes can be used to assist other SIDS and SNIJ in their ambitions to meet the SDGs.

Keywords

Ecosystem Services, Small Island Developing States, Subnational Island Jurisdictions, ecosystem services, Sustainable Development Goals

1. Introduction

Small Island Developing States (SIDS) and other Subnational Island Jurisdictions (SNIJ) share unique characteristics and challenges in the process of achieving the Sustainable Development Goals (SDGs) (UN DESA n.d.). Their vulnerability stems from their limited natural resources, their small size and geographic isolation, making them highly dependent on international trade and vulnerable to external changes (Ghina 2003, Hay 2013, UNEP 2014). The achievement of many SDGs for SIDS is reliant on well-functioning marine and coastal island's ecosystems (e.g. coral reefs, mangroves) and the benefits people derive from them – so-called ecosystem services (ESS) (Millennium Ecosystem Assessment 2005). Notably, the Islands' high dependence on fishing or tourism for their economic prosperity makes them extremely vulnerable to impacts from local pressures and global change, such as unregulated coastal development, climate change or pandemics.

SIDS have taken significant steps in nature conservation and policy-making to fulfil international commitments, such as the expansion of marine and terrestrial protected areas (e.g. Convention of Biological Diversity and 2030 Agenda for Sustainable Development). However, part of the challenge to implement and finance these policies is that the benefits of investing in conserving and restoring healthy ecosystems for the achievement of national and global environmental and socio-economic goals are not yet sufficiently measured and recognised (UN 2019). Revealing the benefits of nature conservation, supports more informed decision-making and facilitates greater access to public and private financing for nature conservation (Hagedoorn et al. 2017).

The Dutch Caribbean Island of Aruba serves as an example for piloting a nature-conserving approach aligned with the SDGs that can be replicated in other similar places. With a population over 100,000, its economy strongly depends on tourism. According to TEEB Aruba, the added value of nature for tourism is estimated at US\$ 269 million/year (van Zanten et al. 2018). Given the high importance of nature for the Island, approaches to mainstream ESS in policy and investment decisions are of utmost importance for Aruba.

This study provides practical tools to help policy-makers using socioeconomic values of ESS to make informed decisions on their national 2030 Development Agenda, nurturing numerical data and legitimate information. Through the development and application of a 5-step approach to the context of the Island of Aruba, this research will contribute to

closing the science-policy gap by emphasising the ESS-SDG interlinkages in a national SIDS context. The main research questions addressed by this study are:

- *How can ESS and the value of natural capital be more effectively incorporated into the 2030 Agenda for SIDS?*
- *How can ESS provide information for investment decisions on selected policy measures from Aruba 2030 roadmap?*

The paper is structured as follows. Section 2 provides the scientific background on ESS and SDGs. Section 3 describes the Aruban political background and context where this research embeds. Section 4 presents the methodological approach. Section 5 explains how the shortlist of indicators is obtained and how this shortlist can provide information for investment decisions on sustainable development policy, as well as spatial planning decisions. Section 6 concludes with a discussion on limitations and recommendations for the application of this approach in other SIDS or SNIJ. For simplification purposes, any reference to SIDS in this paper implicitly includes also SNIJ.

2. Ecosystem services and SDGs

The Millennium Ecosystem Service Assessment (MEA) mainstreamed the ESS concept into environmental research by highlighting and raising awareness on the impact of ESS on human well-being (Millennium Ecosystem Assessment 2005). To enhance the protection or sustainable management of ecosystems and incorporate the value of ESS in policies, management and investments, valuation methods have proven to be a powerful instrument (Kushner et al. 2012). To date, in the Caribbean, more than 200 economic valuation studies have been carried out (Kushner et al. 2012, Oleson et al. 2018). Despite this substantial literature, cultural ESS and immaterial values of ecosystems are under-represented in this research. This lacuna can be traced back to a lack of methodological frameworks and the challenge of capturing intangible non-biophysical and non-monetary values (Chan et al. 2012, Díaz et al. 2018). Emphasising the importance of ESS for diverse facets of sustainable development will contribute to the further development of non-economic approaches to ESS.

The adoption of the 17 SDGs succeeding the Millennium Development Goals should steer UN Member States, including SIDS, in addressing their sustainable development challenges (UN 2015). SDGs relating to societal and economical concerns are as dependent on the well-functioning of our nature as the targets directly related to the conservation of our environment (SDG 6-Clean water and sanitation; SDG 13-Climate action; SDG 14-Life below water; and SDG 15-Life on land). Thus, to achieve the targets established by the SDGs, solutions to maintain ecosystems and manage them sustainably are urgently needed (Wood et al. 2018). Furthermore, the inclusion of natural capital into national development planning and accounting is key to achieve and report progress on the SDGs (Ruijs et al. 2018).

Global efforts to develop systematic approaches to measure ESS and link this information to economic and other human activity reporting, have taken a step further with the adoption of the System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA) by the UN at its 52nd session in March 2021 (UN SEEA 2021a). The usage of a spatially-explicit approach to quantify and model the four ecosystem accounts (i.e. ecosystem extent, ecosystem condition, ecosystem services and monetary ecosystem asset) underpins this systematisation. The guidelines for the biophysical modelling of ESS are currently under global consultation (UN SEEA 2021b). Common guidelines for the socioeconomic valuation of ESS' benefits are yet to be addressed.

The selection of indicators to assess whether a country progresses towards sustainable development is taking a new turn with the *Dasgupta Review* (Dasgupta 2021). Dasgupta claims the necessity to complement traditional economic performance indicators, such as Gross Domestic Product (GDP) with *Inclusive Wealth*^{*1}, which includes Nature as an asset. By doing so, it is possible to assess progress, not just from a 'flow' or annual market price short-term perspective, but from a 'stock' or intergenerational well-being perspective, measuring changes (depreciation or appreciation) in assets, linked to the degradation or restoration of nature. Moreover, the *Dasgupta Review* acknowledges the importance of studying these changes in assets over time at a global level, taking into account what changes, in the different types of capital in a nation, imply for other nations.

Despite these recent advances in the natural capital science-policy interface, there is still little research conducted on the interlinkages between ESS and SDGs. In their pioneer study, Wood et al. 2018 consulted experts about whether good management of ESS can contribute to the achievement of the SDGs. They identified the positive role of 16 selected ESS in the achievement of 41 targets across 12 SDGs. The specific link between marine and coastal ESS to SDGs was analysed by Neumann et al. 2015 who emphasised that a healthy ocean will positively impact 10 of 17 SDGs. Most research on ESS-SDG linkages has been conducted on a global level. According to Waldron et al. 2020, the investments needed to protect and effectively manage 30% of the world's land and ocean by 2030 amount up to USD 140 billion per year (i.e. 0.16% of global GDP), while the annual economic benefits returned by those investments would be 1.2 to 3.8 times higher.

In this paper, we build on the work by Wood et al. 2018 to demonstrate the link between ESS and SDGs for the case study of Aruba and how investing in nature conservation can have a multiplier effect on the implementation of Aruba's 2030 Agenda. The framework approach developed and its outcomes are also discussed with regard to its application to other SIDS or SNIJ.

3. Case study

In Aruba, multiple initiatives have been taking place to implement SDGs at the national level. In 2017, the Aruban government institutionalised the work of the National SDG Commission and the SDG Aruba Indicator Working Group, the two central institutions on SDGs in Aruba, with a ministerial decree. In 2018, the Aruba SDG Indicators Working

Group (IWG) chaired by Aruba Central Bureau of Statistics (CBS) released a Baseline measurement report for the Global Monitoring Indicators (GMIs). However, Aruba is aware of the importance of 'localising' and developing locally relevant SDG measurement indicators for the effective design, monitoring and management of its 2030 Agenda for Sustainable Development. Therefore, Aruba drafted an SDG Roadmap to drive the formulation of its Agenda 2030 with guidance from UNDP and the Economic Commission for Latin America and the Caribbean (ECLAC).

Some countries like Aruba have been applying the 'Mainstreaming, Acceleration and Policy Support' or 'MAPS' approach with the support of UNDP. MAPS is a common approach adopted by UN to support the development and implementation of the 2030 Agenda at the country level (UN 2016). With the application of the MAPS approach, Aruba established intervention priorities in its SDG Roadmap, through "SDG accelerators". Each accelerator is a policy or programme area whose implementation directly addresses certain development priorities and can simultaneously trigger positive multiplier effects across the SDGs (Abud et al. 2017, UNDP 2017). Investing in these accelerators facilitates the most efficient allocation of resources by achieving a multiplier effect and contributing to multiple SDGs targets and goals.

As a result of applying MAPS, Aruba organised its 2030 Agenda along five thematic pillars: People, Planet, Prosperity, Peace and Partnership. Specific working groups were set up around these themes to support the work of the National SDG Commission. The Planet theme working group, led by the Aruba Directorate of Nature and Environment (Directie Natuur en Milieu, DNM), clusters the work on SDGs 6, 12, 13, 14 and 15. The result of our study supported the work of DNM with the development of a list of suitable ESS-SDGs indicators, which were part of the Planet list of indicators proposed by DNM for inclusion in the National Strategic Plan for Aruba (2020-2022).

Against the background of this study, it is important to highlight the strong ongoing efforts to align ESS TEEB Aruba indicators within Aruba's National Statistical System (NSS). Already in 2013, the Central Bureau of Statistics (CBS) of Aruba established the Environmental Statistics Department, where the vision is to follow the international community (e.g. UN, OECD, World Bank) and the aspiration is to complement the current System of National Accounts (SNA) with System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA) (Derix 2014). Therefore, the TEEB Aruba indicators are an excellent starting point for monitoring and achieving the SDGs in relation to ESS, as well as an important data source for the future SEEA - EA in Aruba.

4. Methods

Using step-wise approaches for achieving a better understanding and consideration of the value of ecosystems and their services in policy-making has become increasingly popular. Organisations, such as the World Resource Institute (WRI), source a wealth of toolkits addressing the mainstreaming of ESS in decision-making. In 2008, the WRI set up a 5-step approach to guide decision-makers in including a sustainable management of ESS in their

policies focusing, thereby, on risk and opportunities (Ranganathan et al. 2008). Based on the TEEB approach, the German Agency for International Cooperation (GIZ) published a stepwise guide for supporting practitioners (Kosmus et al. 2011). Despite the vast number of guiding tools for incorporating the ESS approach in decision-making and connecting ESS and development, practical approaches on how to prioritise ESS in the SDG agenda and, specifically, in SIDS' context, are as yet lacking. Therefore, through a 5-step approach, our study develops a practical solution for the ESS-SDGs science-policy interface in SIDS, by relying on the effective integration of readily available local information, while providing an example application of previous valuation ESS results into current development policies in Aruba.

Fig. 1 shows the 5-step approach for application in Aruba. The 5-step approach was developed with the aim to analyse the importance of sustainable management of ESS for the achievement of SDGs on the basis of stakeholder consultation and completion of a questionnaire on the links ESS-SDGs. Upon the application of the 5-step approach to the case study of Aruba, a shortlist of selected indicators linking ESS and SDGs for Aruba is obtained. Moreover, the analysis identifies strategic ESS which generate a maximum positive impact on SDGs, thereby justifying targeted investments.

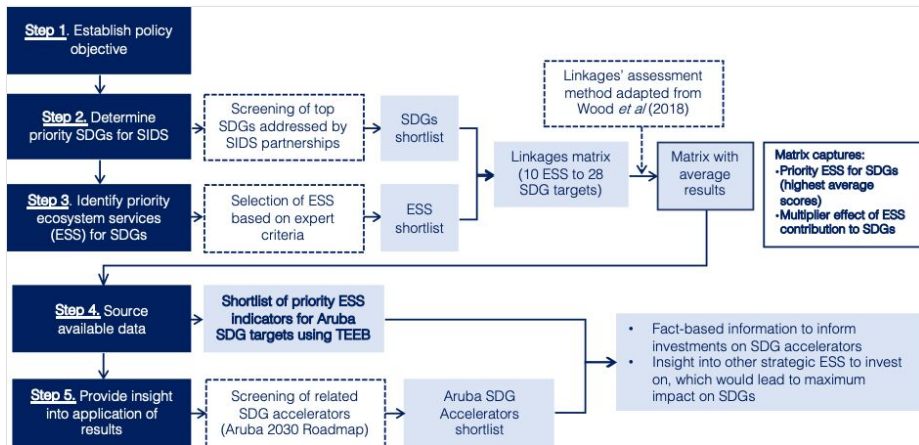


Figure 1.

The 5-step approach proposed to support policy-makers mainstreaming ESS in development policies.

The methodological foundation for the development of the 5-step approach lies on the following three cornerstones: first, the research by Wood et al. (2018) on the role of ESS to achieve SDGs, which serves as a base for the design and realisation of the stakeholders' consultation in the SIDS context of Aruba (Step 3); second, the TEEB Aruba study (Wolfs et al. 2017, van Zanten et al. 2018, Polaszek et al. 2018) that provides socioeconomic values and data of ESS (TEEB indicators), which are used as input to the shortlist of ESS-SDGs indicators (Step 4); and third, the policy priorities established through "SDG accelerators" in Aruba 2030 Roadmap (Government of Aruba 2018) (Step 5). Each step in the 5-step approach is explained in the following:

Step 1: Establish policy objective

Step 1 involves the formulation of the policy objective(s) or policy question(s) to be answered. The motivation for this research is founded in DNM's interest to actively utilise the ESS valuation results of the TEEB Aruba study (Wolfs et al. 2017, van Zanten et al. 2018, Polaszek et al. 2018) by facilitating their integration into sustainable development policies.

Step 2: Determine and assess priority SDGs for SIDS

In Step 2, first, priority SDGs for SIDS were 'pre-selected', based on an extensive literature review and the analysis of the number of SIDS partnerships working towards specific SDGs' achievement. The pre-selection was based on the premise that, the more abundant the SIDS partnerships work towards a specific SDG, the more important that SDG is for SIDS. Given the limited capacity of hierarchic and market-based forms of governance in solving global problems, networked forms of governance, such as partnerships, are identified as a means to solve global problems by fostering policy implementation, knowledge transfer and financial support (van Huijstee et al. 2008, Beisheim and Liese 2014). Thus, partnerships are considered a good means to demonstrate priority issues. Furthermore, the Samoa Declaration - the blueprint for the achievement of sustainable development in SIDS - emphasised that partnerships are the cornerstone for sustainable development (SIDS Partnership and UN DESA 2016). This prioritisation allows us to focus on the most pressing problems of SIDS. Still, it needs to be taken into consideration that some partnerships are financed by governments and donors and do not necessarily reflect the needs of the local population. The pre-selection of priority SDGs for SIDS realised in this study can be used, fine-tuned or expanded in the application of the 5-step framework to other SIDS.

Second, in the application to any SIDS, policy-makers would need to consider the interconnections between priority SDGs, their synergies and their trade-offs (Le Blanc 2015). Identifying and understanding their linkages is an indispensable prerequisite for developing coherent and effective policies and strategies (Nilsson et al. 2016, ICSU 2017). In the case study application for Aruba, we took stock of the previous participatory work realised by the Government with the Aruba 2030 Roadmap, which involved discussions and agreement on priority policy areas to implement SDGs, the so-called "SDG accelerators" (Government of Aruba 2018).

Step 3: Identify priority ESS for SDGs

Following the approach used by Wood et al. (2018), a detailed questionnaire was developed to gather stakeholders' opinions of 'How important ESS are for the achievement of SDG targets?' Wood et al. (2018) implemented an expert survey to assess the contribution of 16 ESS to achieve selected SDG targets connected to environment and well-being. Respondents were asked to select up to three ESS and SDG targets from up to two SDGs. Then, for each one-to-one ES-SDG target linkages, respondents were asked: whether they 'agreed', 'disagreed' or 'didn't know' if good management of the selected ES

could help achieving the target; to rank how important they considered the contribution of the ES to the target on a four-point scale ranging from 'not important' to 'high'; and to assess confidence in their own evaluation of the relationships. For the analysis of results, median responses were used.

In the Aruba case study, two consultation rounds took place involving international SIDS experts and Aruban local stakeholders in May 2018. Research participants were consulted in two ways: via questionnaire and in-person interviews. In total, the questionnaire was completed by 22 international experts in SIDS, SDGs and/or ESS (response rate of 20%) and 11 Aruban stakeholders, who were also interviewed in person (Fig. 2).

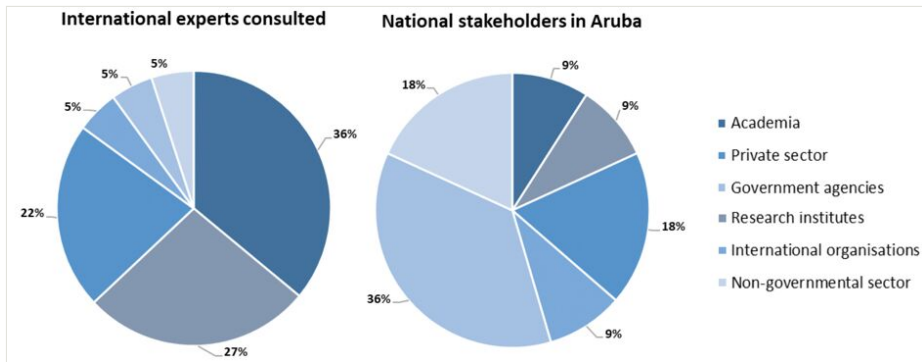


Figure 2.

Representation of the different stakeholder groups in the international and national consultation in Aruba

In contrast to the Wood et al. (2018) study, the questionnaire was conducted on a pre-selection of linkages (10 ESS to 28 SDG targets – those resulting from Step 2). The priority ESS with a direct or indirect link with these SDG targets achievement were shortlisted according to expert criteria. These include four provisioning ESS (i.e. fisheries, crops, raw materials, freshwater supply), regulating ESS (i.e. flood regulation and moderation of extreme events, atmospheric and climate regulation, erosion control, water purification) and two cultural ESS (i.e. nature-based tourism, local cultural and recreational services). A matrix was provided displaying the one-to-one ES-SDG target linkages and respondents were asked to rank the contribution of ES to SDG target on a scale of importance (3: very important; 2: important; 1: not important; ?: I don't know).

Stakeholders' perceptions of ES-SDG target linkages were analysed. The average values of the scores provided by respondents to each ES-SDG target linkage were calculated, while also accounting for the level of consensus between respondents. Due to the structural difference in scoring between international experts and local stakeholders, slightly different benchmarks were applied in the interpretation of results from these groups. In the analysis of international consultation results, ES-SDG target linkages with average scores > 2.85 were considered as 'very important'; and coefficients of variation up to 17% were considered low. In the analysis of local consultation results, given the smaller sample size,

ES-SDG target linkages with average scores ≥ 2.73 were considered as 'very important'; and coefficients of variation up to 24% were considered low.

Step 4: Source available data on priority ESS for SDGs and deliver a shortlist of indicators for SDG targets

As mentioned previously, the preferred approach undertaken in this study was to effectively integrate readily-available information. Therefore, when available, it is recommended to source data from previous studies on ESS' values or, alternatively, make use of existing socioeconomic indicators to assess certain ESS values. In Aruba, the TEEB study (Wolfs et al. 2017, van Zanten et al. 2018, Polaszek et al. 2018) was used to source socioeconomic values of different ESS. For non-monetisable ESS, visual geographical maps demonstrating the perceived importance of ecosystems for recreational, aesthetic and cultural purposes were also sourced from the TEEB study. The SDGs, tackled by each SDG accelerator, were used to support shortlisting indicators that relate ESS to SDGs, as well as to contextualise the results in the next step (Step 5). With the information sourced, a shortlist of ESS indicators for SDG targets was delivered.

When such socioeconomic information is not available, a wide array of methodologies with different levels of complexity can be applied to assess the socioeconomic value or importance of ESS. These include, for example, the use of remote sensing techniques and geographic information systems, together with the analysis of primary data from tailored questionnaires on valuation, the use of secondary socioeconomic data and indicators, expert opinion or participatory mapping (Geneletti et al. 2020).

Step 5: Provide insight into the application of results to maximise the multiplier effect of investing on ESS to achieve SDG targets

Especially in the context of SIDS, available financial, technical, human and institutional capacities play a decisive role integrating the value and sustainable management of ESS in legislation, policies or investments (Kosmus et al. 2011). Moreover, due to SDGs interlinkages and dependencies, structural coordination is needed between the institutions directly in charge of managing nature-based SDG targets (e.g. marine protection) and those responsible for other SDG targets (e.g. consumption and production systems and economic transformation) which are pre-requisites to achieve the first (Singh et al. 2021).

In the case study for Aruba, we reflect on how the fact-based evidence, delivered by the shortlist of ESS-SDG target indicators and TEEB Aruba ESS visual maps, could provide information for policy decisions on certain SDG accelerators and lead to multiplying the co-benefits for other SDGs. We also discuss how TEEB Aruba ESS results have been used to provide information for other (spatial) planning decisions and processes.

5. Results

Step 1 involved the establishment of the policy objectives. The objective of this research was twofold. First, to demonstrate the contribution of individual ESS to the achievement of

multiple priority SDG targets for SIDS; and second, to deliver a short list of ES-SDG target indicators and provide evidence to make informed efficient investment decisions on selected SDG accelerators in Aruba.

Step 2 delivered the following list of priority SDGs and targets for Aruba (see Fig. 3).


Priority SDG	Selected targets
	2.2 End malnutrition by 2030 2.3 Double agricultural productivity 2.4 Ensure sustainable food production
	3.3 End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases 3.9 Reduce the number of deaths and illness from hazardous chemicals and air, water and soil pollution and contamination
	7.1 Ensure universal access to affordable, reliable and modern energy services 7.2 Increase substantially the share of renewable energy in the global energy mix
	8.2 Achieve higher levels of economic productivity through diversification 8.4 Improve global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation 8.9 Devise and implement policies to promote sustainable tourism
	11.5 Reduce the number of deaths and losses caused by disasters
	12. 2 Achieve sustainable management and efficient use of natural resources 12.3 Halve per capita global food waste 12.4 Achieve environmentally sound management of chemicals and wastes 12.5 Substantially reduce waste generation
	13.1 Strengthen resilience and adaptive capacity to climate related hazards and natural disasters
	14.1 Prevent and significantly reduce marine pollution 14.2 Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts 14.3 Minimize and address the impacts of ocean acidification 14.4 Effectively regulate harvesting and end overfishing 14.5 Conserve at least 10 per cent of coastal and marine areas 14.7 Increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources
	15.1 Conserve terrestrial ecosystem and ecosystem services 15.2 Promote implementation of sustainable management of forests 15.3 Combat desertification 15.4 Conservation of mountain ecosystems 15.5 Reduce degradation of natural habitats 15.8 Prevent the introduction of invasive species

Figure 3.

List of priority SDGs and targets pre-selected for SIDS and for the consultation process in Aruba.

Step 3, first, delivered ten priority ESS with a direct or indirect link with these SDG targets achievement, based on expert criteria. Priority ESS include four provisioning ESS (i.e. fisheries, crops, raw materials, freshwater supply), four regulating ESS (i.e. flood regulation and moderation of extreme events, atmospheric and climate regulation, erosion control, water purification) and two cultural ESS (i.e. nature-based tourism, local cultural and recreational services). Second, Step 3 served to identify the main ES-SDG targets linkages. Fig. 4 and Fig. 5 show the questionnaire matrix results from international experts and national stakeholders, respectively. The cells highlighted in green show the most important ES-SDG target linkages with average values scoring above 2.85 and 2.82 according to international experts and national stakeholders, respectively.

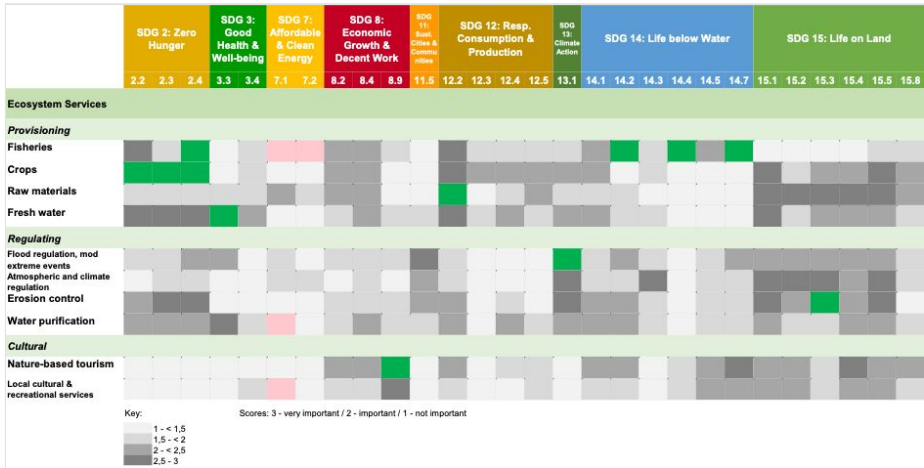


Figure 4.

Assessed importance of ESS for SDG targets by international experts. Score based on mean values (3: very important; 2: important; 1: not important; ?: I don't know). The cells highlighted in green indicate those ESS-SDG target links scoring mean values > 2.85 (very important). The cells highlighted in pink indicate those ESS-SDG target links scoring mean values of 1 (not important).

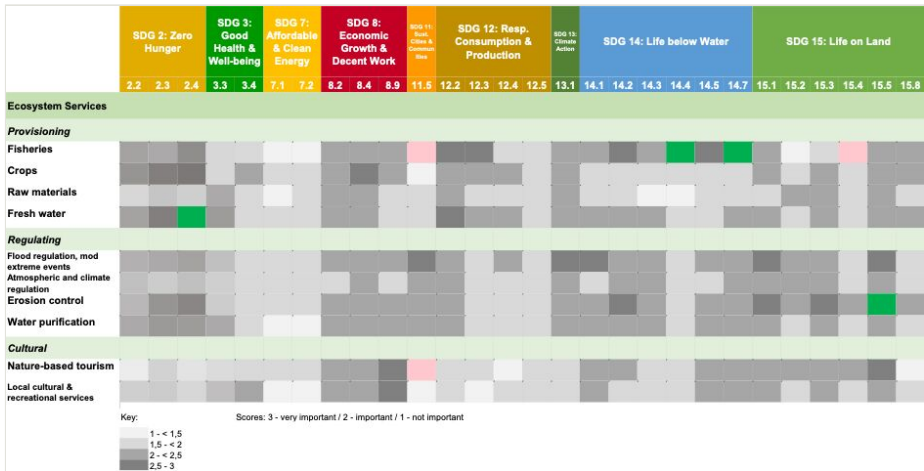


Figure 5.

Assessed importance of ESS for SDG targets by local stakeholders. Score based on mean values (3: very important; 2: important; 1: not important; ?: I don't know). The cells highlighted in green indicate those ESS-SDG target links scoring mean values > 2.82 (very important). The cells highlighted in pink indicate those ESS-SDG target links scoring mean values of 1.2 (not important).

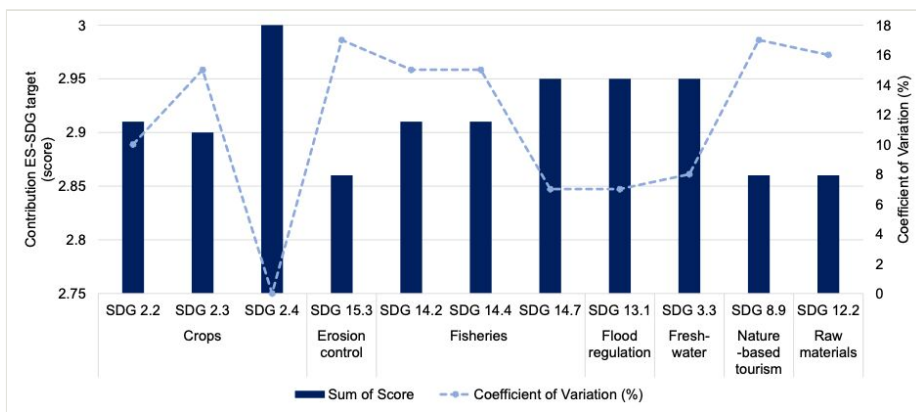


Figure 6.

Results of the international consultation about SIDS: the sustainable management of the ES is perceived as 'very important' for the achievement of the SDG target in SIDS (score > 2.85 with high consensus amongst respondents (Coefficient of Variation 0-17%).

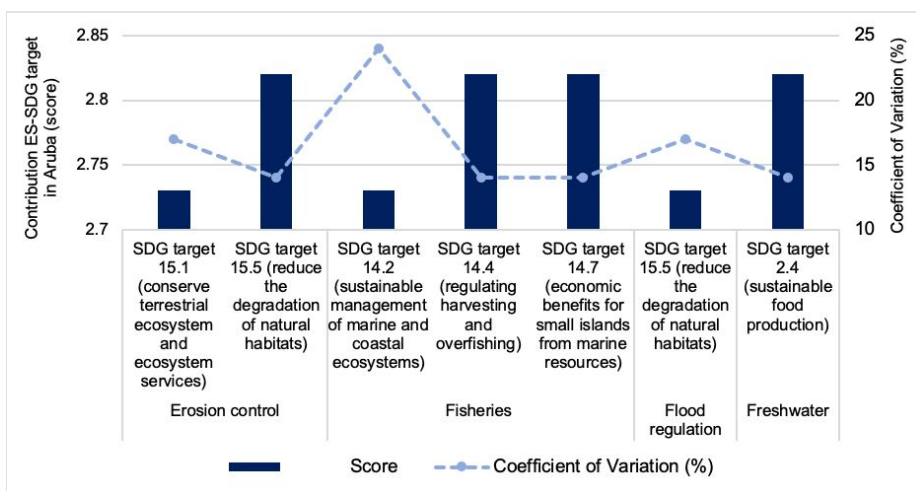


Figure 7.

Results of Aruban consultation: the sustainable management of the ES is 'very important' for the achievement of the SDG target in Aruba (score > 2.73 with high consensus amongst respondents (Coefficient of Variation 0-24%).

Fig. 6 and Fig. 7 show the selection of one-to-one ES-SDG target linkages where stakeholders perceive the sustainable management of the given ES as 'very important' for the achievement of the given SDG target (i.e. linkages with highest average score and lowest coefficient of variation). At the international level, the highest consensus on the 'very important' contribution of an ES for the achievement of an SDG target in SIDS was found in the cases of: crops for the achievement of SDG target 2.4; fisheries for the achievement of SDG target 14.7; flood regulation for the achievement of SDG target 13.1; and

freshwater supply for the achievement of SDG target 3.3. Arubans most highly agree on the 'very important' contribution of sustainably managing: fisheries for the achievement of SDG targets 14.7 and 14.4; freshwater for the achievement of SDG target 2.4; and erosion control for the achievement of SDG target 15.5.

Overall, both internationals and locals *highly agree* that the sustainable management of fisheries is *very important* for the achievement of SDG targets 14.2, 14.4 and 14.7. After these, regulating services (flood and erosion control) and provisioning services (freshwater supply) top in importance in both groups of respondents for the achievement of SDGs in SIDS and particularly in Aruba. Generally, international stakeholders *highly agree* on the importance of nature-based tourism for the achievement of SDG 8.9 in SIDS.

Step 4 dealt with sourcing available data on priority ESS to quantitatively capture their contribution to the achievement of priority SDG targets, by means of a shortlist of indicators. Lack of data is an issue generally recognised for many of the ESS that were prioritised by local stakeholders in Aruba. From the identified ESS in Fig. 6 and Fig. 7, the TEEB Aruba study provides appropriate metrics of the socio-economic value of fisheries, as well as socioeconomic data on nature-based tourism. TEEB Aruba also provides information on how Arubans perceive the importance of nature for cultural and recreational activities and their well-being. For example, Fig. 8 presents hotspots maps capturing the contributions of three ESS to the selected SDG targets.

Table 1.

Shortlisted indicators. Data on 'TEEB ESS indicators' and 'baseline values' extracted from (Wolfs et al. 2017, van Zanten et al. 2018, Polaszek et al. 2018). The column 'Contribution of the ES to the SDG target' indicates when there is 'high agreement' amongst respondents that the sustainable management of the ES is 'very important' or 'important' for the achievement of the SDG target.

TEEB ES indicator	Baseline value (2017)	Contribution of ES to SDG target	SDG target
Fisheries value	4.45 million USD	Very important	SDG target 14.7 (economic benefits for small islands from marine resources)
Tourists WTP enhanced nature protection (*)	10.6 million USD	Important	
Local WTP enhanced nature protection (**)	3.6 million USD		
Nature-based tourism expenditure	269 million USD	Very important	SDG target 8.9 (devise and implement policies to promote sustainable tourism)
Nature-based tourism services	Hotspots spatial maps (see below)		
Local cultural recreational services	Hotspots spatial maps (see below)	Important (***)	SDG target 3.4 (reduce premature mortality from non-communicable diseases through prevention and promote mental health and well-being)

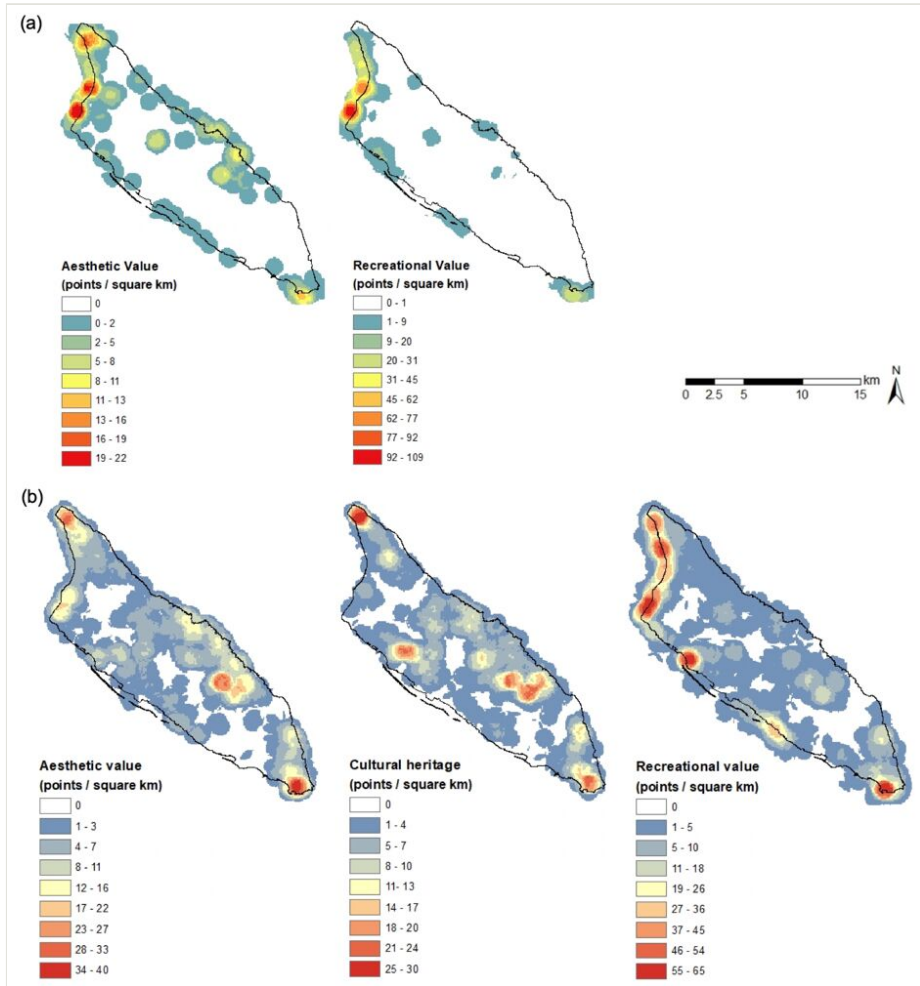


Figure 8.

TEEB Aruba hotspots maps: (a) Aruba's nature values relevant for tourists; (b) Local cultural recreational services relevant for Arubans. These density point maps were built using participatory mapping (PPGIS). In total, around 350 tourists and 350 residents appointed the locations where they engaged in recreational activities (marine and terrestrial) and those which they perceived as having a high aesthetic value. Moreover, residents also appointed the locations of outmost importance for the cultural identity of the Island.

Matching the outcomes of stakeholder consultation with the available TEEB Aruba results on ESS' values and importance, it is possible to capture the contribution of three ESS (fisheries, nature-based tourism and local cultural recreational services) to the achievement of specific SDG targets. Table 1 summarises the indicators, providing for each ES indicator, the 2017 baseline value as calculated in TEEB Aruba and the relevance of the ES' contribution to the achievement of the specific SDG targets as stated by the respondents in the consultation.

Note: Given the type of metrics provided by TEEB ES indicators (*) and (**), they have been considered key indicators of the importance of “nature-based tourism” and “local cultural recreational services”, respectively. (***) The contribution of local recreational services to SDG target 3.4 is considered on average ‘important’ while there is less consensus in the answers (CV > 40%). However, given that TEEB Aruba hotspots maps deliver relevant information on these ESS and valuable spatial insight for investments on SDG target 3.4., this link is considered worthy of inclusion.

Aggregating the results at the SDG level shows that stakeholders consider the contribution of fisheries, nature-based tourism and local cultural recreational services ‘very important’, namely for SDGs 8, 14 and 15 in SIDS and particularly in Aruba. The spider-web graphs in Fig. 9 illustrate these perceptions and the multiplier effect of investing on these strategic ESS which could potentially maximise the positive impact on SDGs.

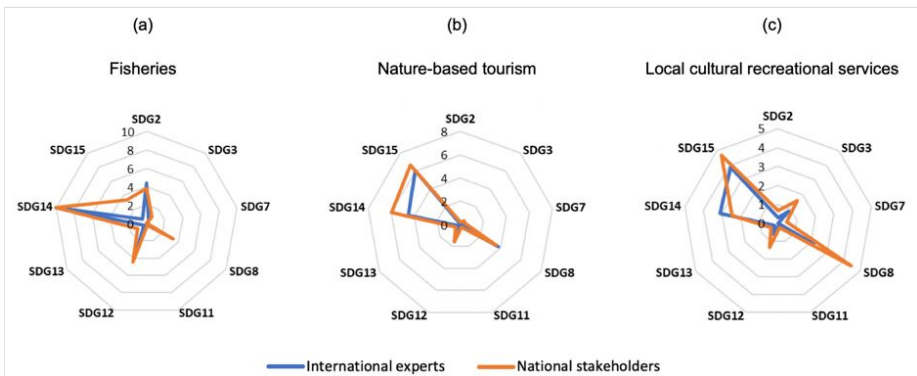


Figure 9. National vs. international stakeholders’ perception of the ‘very important’ contribution of the sustainable management of (a) fisheries, (b) nature-based tourism and (c) local recreational services, to the achievement of the different SDGs.

Step 5 involves the analysis of the Aruba SDG accelerators, contextualising these above findings and applying them to make informed policies and investment decisions in practice. Table 2 shows the three accelerators or policy areas susceptible to receipt of accurate information. It also shows the multiplier effect on SDGs of each accelerator (Government of Aruba 2018) and highlights, in bold, those SDGs that would most directly benefit from the information delivered by the TEEB Aruba shortlist of indicators and the hotspots’ maps indicated in Table 1. With the completion of Step 5, we provide insight into how the quantitative evidence delivered by the shortlist of ESS-SDG target indicators could be used to provide information for policy/investment decisions on certain SDGs accelerators, as well as into how investing on other ESS (currently lacking quantitative data) could lead to optimising investments.

The selected TEEB ESS indicators and hotspots’ maps provide information for policy/ investment decisions on SDGs accelerators in three ways. The first accelerator focuses on improved natural resources management. Accounting the current value of fisheries enables

tracking of fisheries' stock and revenues annually, as well as assessing the economic effects of the potential creation or expansion of marine protected areas for fishermen. The sustainable management of this ES contributes to the achievement of SDG 14 and, 'very importantly', to SDG target 14.7 (i.e. economic benefits for small islands from marine resources), as stated by both local and international stakeholders. Besides, the inclusion of the TEEB indicators "Tourists and Local population willingness to pay for enhanced nature protection" (e.g. creation or expansion of protected areas) is considered relevant to make informed decisions for the implementation of the measures foreseen by this accelerator.

Table 2.

Shortlisted SDG accelerators and related policy measures.

Aruba SDG accelerator (or policy area)	Description	Measures / Approach	Multiplier effect on SDGs
Improved natural resources management (pillar Planet)	Aruba government wants to improve natural resources management by incentivising sustainable use of oceans and coastal assets and addressing emerging threats to coral reefs conservation	<ul style="list-style-type: none"> · Creation/Expansion of Marine Protected Areas (MPAs) · Ensuring sustainable finance mechanisms for MPA management · Fostering sustainable fisheries 	SDGs 6, 8, 11, 12, 13, 14 , 15
Sustainable Tourism (pillar Prosperity)	Aruba government is aware of the link between a healthy environment and the tourism sector , for which the coastal and marine ecosystems are the major attraction. Government is also aware of rapid coastal development which impacts the natural assets that support tourism.	Incentivise quality tourism (increasing its value) and balance development .	SDGs 1, 6, 7, 8, 9, 10, 12, 13, 14 , 15, 17
Improved quality of life and well-being (pillar People)	Currently, unhealthy lifestyles are a matter of concern for Aruba government . In the adult population (25-64 years old), 77% suffers from obesity, 42.2% form high cholesterol and 39.2% from high blood pressure. Mental illnesses are also on the rise and there is major concern for loneliness and lack of social cohesion.	Promotion of activities to improve the physical and mental health of the community	SDGs 1, 3, 4, 8, 10, 11, 16

The second accelerator addresses sustainable tourism. The sustainable management of nature-based tourism ES contributes to the achievement of SDG 8 and, 'very importantly', to SDG target 8.9 (i.e. devise and implement policies to promote sustainable tourism), as stated by international experts. By tracking annual nature-based tourism expenditure and tourists' willingness to return to the Island because of nature-related motives, it would be possible to gain further insight into whether Aruba's natural assets are being preserved. According to TEEB Aruba (van Zanten et al. 2018, p.3), the part of the value added created in the tourism industry that can be attributed to the natural environment of Aruba is estimated at US\$ 269 million. While tourism revenues are currently high, they are strongly linked to the health of the ecosystems. Continued threats upon ecosystems may make them reach their tipping point and may cause a sharp drop in tourism-derived income. By

adopting the System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA) and integrating natural capital into the System of National Accounts (SNA), it would be possible to assess nature-based tourism derived income as a function of ecosystems' health and condition.

The third accelerator targets improved quality of life and well-being. By spatially mapping the importance of local cultural and recreational ESS, it is possible to assess how many people are benefiting from nature to improve their quality of life and well-being and to track what are the key Island areas for these activities. Potentially, this could also serve to provide information for government investments in activities for the health of the community (e.g. signalling of walking paths, construction of a bike lane etc.). The sustainable management of these ESS contributes to the achievement of SDG 3 and, 'importantly', to SDG target 3.4 (i.e. reduce premature mortality from non-communicable diseases through prevention and promote mental health and well-being), as stated by both local and international stakeholders. TEEB Aruba identifies that 70% of Arubans visit natural environments to relax and unwind and 68% find urban and peri-urban green spaces 'very and extremely important' for improving social cohesion (Wolfs et al. 2017).

The findings regarding targeting investments on the first two indicated SDG accelerators align with those of Singh et al. (2021), p.1, who stated that "prioritizing increased economic benefits from sustainable marine development, including those of tourism, provides the greatest amount of direct co-benefits to other SDGs" in Aruba.

The uptake of the results of this study has influenced the prioritisation of SDG targets addressed by the National Strategic Plan of Aruba 2020-2022 (NSP) (Government of Aruba 2020). The SDG targets that can be identified using ESS data are prioritised in the 2030 vision of each SDG accelerator, as developed by the NSP. Beyond the concrete applications on the development of SDGs' policies and potential accounting, the results of local cultural and recreational values delivered by TEEB Aruba also served to provide information for spatial planning and related decision-making processes, in various ways. First, TEEB Aruba value maps were provided as input in the update process of Aruba Physical Development Policy Plan 2019. Second, TEEB Aruba research results were used to further validate the importance of various prime ecosystems within Aruba's Concept Spatial Plan 2019. Third, maps of hotspots were included instrumentally in the decision-making process which led to halting the project and securing the conservation of natural mangrove areas.

6. Conclusions and recommendations

SDGs are a worldwide policy tool to lever progress towards sustainable development. However, measuring and reporting on SDGs is especially challenging in SIDS, given the complex connection between national policy goals and the strong reliance of SIDS on well-functioning marine and coastal ecosystems. Therefore, downscaling or "landing" internationally-agreed goals, such as the SDGs in the context of SIDS, demands relatively more effort from governments and institutions given their limited capacities.

In this study, we make use of readily-available data and hands-on methodologies on ESS to generate SDGs indicators which are crucial for efficient and effective management of sustainable development in SIDS. We developed a practical 5-step approach to SDGs specifically tailored towards the context of SIDS and applied the approach in Aruba. Aruba is highly dependent on its coastal and marine ecosystems for its economy and well-being. As in many other island contexts, where this dependency is crucial, the linkages between the benefits provided by nature and sustainable development are as yet poorly recognised and integrated into policy-making. The 5-step approach is policy-driven and provides fact-based information, based on numerical data, thereby supporting the effective incorporation of ESS and the value of natural capital into the 2030 Agenda in SIDS. The 5-step approach enables governments in SIDS to get a better understanding and analytical control of SDGs within their operational capacity. Overall, the 5-step approach provides practical guidance and support to island policy-makers to mainstream the sustainable management of ESS into the Development of Agenda 2030 at the local level.

In the application of the 5-step approach to the case of the Island of Aruba, the strategy to validate the shortlist of indicators was marked contextually by the ongoing process of localisation of SDGs and the leading role of environmental government officials in identifying SDG indicators. Throughout the process, the authors worked with local officials to develop the shortlist of salient ESS-SDG targets indicators, which was used by the Directorate of Nature and Environment of Aruba to advocate for the importance of nature conservation in Aruba's implementation of the SDGs.

The shortlist of ESS-SDG targets exerted certain influence on the prioritisation of SDG targets to address with the National Strategic Plan of Aruba 2020-2022. However, increased capacity building on the importance of nature for economy and well-being across government departments, as well as a reinforced legal base on nature conservation, are necessary to achieve the desired advocacy impact. ESS values also proved to be instrumental in other types of sustainable development decision in Aruba, influencing processes beyond SDGs' policies and potential SDG's accounting, such as spatial planning and nature conservation decisions.

From our study, we derive a number of recommendations that tailor the application of the 5-step approach to other SIDS and SNIJ. First, allocate sufficient time to identify and discuss the policy question or decision-making process that should be informed by the results of applying the 5-step approach. If this step is conducted hastily, less relevant objectives may steer the whole process in less urgent directions with insufficient stakeholder support. Second, tailor the selection of SDGs (targets) and ESS hereby provided to the local context as much as possible. In doing so, adequately select and follow up with stakeholders during the consultation process to ensure their participation. Third, team up with a local partner or champion with knowledge of the local stakeholders working on SDGs and environmentally-related issues. It is important to raise the sensitivity and interest on the topic within national stakeholders while building ownership of the approach. Be aware that the consultation process does not only generate valuable indicators, but it also helps to raise awareness on the importance of natural capital for the sustainable development of a community. Fourth, review local studies and policy

developments that can effectively source relevant information for the analysis. Anticipate lack of data and prepare ways to collect information on the value of ESS, either through tailored studies or using information from previous ESS valuation studies. Fifth, to facilitate the up-take of the recommendations, it is key to have a good understanding of the ongoing political processes and their timings (e.g. localisation of SDG indicators, preparation of national development policies). In those SIDS and SNIJ, applying the UNDP MAPS approach and developing SDG accelerators for their 2030 Roadmaps, linking ESS multiplier effects to those of SDG accelerators can also strengthen their added value to provide information for policies. Finally, tailor the indicators to the SIDS context and find a compromise between data availability and most suited data to provide information for the policy question. To get things done in the challenging research and policy conditions in which most SIDS operate, not only a comprehensive, but also a pragmatic approach is key.

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Ethics and security

In undertaking research and collecting information from primary and secondary sources, the study team applied the fundamental ethical principles in terms of confidentiality, informed consent, citation and integrity of data, as stated in the European Code of Conduct For Research Integrity.

Author contributions

Elena Palacios Nieto (conceptual and methodological design, data analysis, writing); Pieter van Beukering (conceptual and methodological design, writing, reviewing); Boris van Zanten (conceptual and methodological design, reviewing); Francielle Laclé (conceptual and methodological design, data collection and stakeholder consultation, reviewing); Stijn Schep (conceptual and methodological design, reviewing); Inga Soellner (data collection and stakeholder consultation, data analysis, writing).

Conflicts of interest

The authors hereby declare that there are no conflicts of interest.

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Endnotes

- *1 Inclusive Wealth is defined as the sum of the accounting values of produced capital (tools, machines, buildings and infrastructure), human capital (knowledge, aptitude, education, health and skills) and natural capital (plants, animals, air, water, soils and minerals) (Dasgupta 2021)