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Governing the Land-Sea Interface to Achieve Sustainable Coastal Development

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Coastal regions are essential to achieving the Sustainable Development Goals (SDGs) given their importance for human habitation, resource provisioning, employment, and cultural practice. They are also regions where different ecological, disciplinary, and jurisdictional boundaries both overlap and are obscured. We thus propose the land-sea interface as areas where governance systems are most in need of frameworks for systems analysis to meet the SDGs—which are inherently interconnected— and integrate complex interdependencies between human livelihoods, energy, transport, food production, and nutrient flows (among others). We propose a strategic land-sea governance framework built on the sustainable transitions literature to plan for governance to achieve sustainable development across the land-sea interface. To illustrate our proposal, we compare governance planning processes across four case-based scenarios: an industrialized coastal country, a least developed coastal country, a developing coastal country with local dependencies on ocean resources, and a small island developing state primarily dependent on tourism. Through the lens of aligning governance actors and actions vertically (subnational to national), horizontally (across sectors), and programmatically (from goals to implementation), we propose scales at which governance systems may be misaligned, such as where different agencies that affect marine systems have conflicting visions and goals, leading to stalled progress or counterproductive actions. Where possible, we also highlight strategies to align across scales of high level strategic policy, tactical scale institutional mandates and cooperation, and on the ground activities and operations, such as aligning actors based on an analysis of interdependencies of goals.

Keywords: land-sea interface, transition management, sustainable development goals, governance, policy alignment, coastal systems

INTRODUCTION

Coastal systems are home to a large proportion of the world's population, directly support hundreds of millions of livelihoods, and are the direct link between marine resources and seafood supply chains, especially in coastal countries and island states (Singh et al., 2018; Selig et al., 2019; Lam et al., 2020). The land-sea interface that defines coastal systems faces a broad array of impacts from climate change (including stressors from mean temperature rise, ocean acidification, and extreme weather events) across all dimensions of the Sustainable Development Goals (SDGs) (Singh et al., 2019). Importantly from a systems perspective, coasts are also directly impacted by land-based pressures and human activities including increased erosion and sedimentation, nutrient loading, and many forms of pollution stemming from agriculture, urbanization and energy production (Lotze et al., 2006; Halpern et al., 2015; Singh et al., 2017, 2020; Nordhaus et al., 2018). Many of these pressures and industrial sectors do not account for, and may not be aware of, (sometimes literal) downstream impacts on the oceans (Halpern et al., 2008). Governance and decision-making to promote sustainable development for the land-sea interface must therefore be integrative across diverse dimensions of social-ecological systems.

Because coastal systems are so important to people and are so social-ecologically complex, sustainable coastal development is essential for achieving the SDGs. Here, we define coastal sustainable development as human activities and planning processes that contribute across the SDGs and minimized trade-offs between SDG objectives. We are explicitly concerned with development outcomes across multiple SDG outcomes as sustainable development is a multi-criteria problem, and we focus on the SDGs since they are the most widely accepted definition of sustainable development. While a comprehensive and wide-spanning systems approach is clearly necessary to address coastal sustainability issues, this can be a very complex task. Achieving this integrated policy requires a transition away from current institutional regimes, and navigating this transition is often not intuitive (Blythe et al., 2018; Bennett et al., 2019). Frameworks to help structure governance systems to achieve sustainability initiatives have been developed in political science as a planning and research framework for transitioning from current governance systems to integrated policy systems in order to achieve sustainable development objectives (Kemp et al., 2007; Loorbach, 2007; Rotmans and Loorbach, 2009; Loorbach, 2010; Broman and Robèrt, 2017). However, frameworks for structuring governance systems around sustainability goals have not had wide uptake in SDG planning or for environmental governance planning in general (but see, Singh, 2020; Singh et al., 2021).

Recent research focused on interlinkages between UN SDG targets—the most comprehensive contemporary set of multi-disciplinary development objectives—has highlighted the fact that there are both direct and more complex tradeoffs and co-benefits across different policy objectives (Nilsson et al., 2018; Singh et al., 2018, 2021). In some cases, making progress on coastal sustainability can directly contribute to SDG areas such as food security (SDG 2), longer term economic and employment opportunities (SDG 8), and improved ecosystem states (SDGs 14 and 15) (Blanchard et al., 2017; Lotze et al., 2019). In other cases, however, progress can be highly dependent on actions taken on other SDGs, such as how the revenues generated from sustainable coastal development can promote poverty reduction and habitat restoration depending on how these revenues are distributed and invested (Singh et al., 2018).

Beyond determining which SDG topic areas are needed to promote a given policy goal (and which SDG topic areas can be detrimental for a given goal), governing the land-sea interface will require an understanding of *what* management activities to conduct and *how* to best achieve these activities. Aligning management activities in the context of interlinked SDG topic areas requires coordination in a governance system (Singh, 2020; Singh et al., 2021). Coastal systems are often governed by multiple institutions siloed across the multiple sectors of coastal systems (e.g., fisheries, forestry, agriculture) (Halpern et al., 2008). Siloed management can lead to counterproductive outcomes when institutional missions and activities do not align, or when side-effects from one sector affect another (Cottrell et al., 2018, 2019). Though a substantial literature has been developed addressing how siloed management can lead to counterproductive and uncoordinated results, what is missing is a systematic framework to determine how to align institutions to achieve coordinated action toward desired goals (Singh, 2020). Here, we offer a strategic land-sea interface governance framework based on the sustainable transitions and policy coherence literatures, and provide case studies viewed through the lens of this framework.

ALIGNING GOVERNANCE IN LAND-SEA INTERFACE FOR SDGs

Coastal settings have the potential for complex dynamics across all social, economic, and biophysical dimensions of the SDGs, as they include both marine and terrestrial ecosystems with dense human population, and a diverse set of resource users. Determining how SDGs interlink in these regions is therefore very important given the numerous potential interactions available to explore.

The SDGs are listed as 17 discrete goals, each with a set of more specific targets. Interlinkages between the goals are recognized and the SDGs were written to be "indivisible," even if these linkages are not explicitly included in the SDG Agenda (UN, 2015). Identifying and exploring interlinkages is thus vital for understanding how pursuing specific SDGs can affect others and such assessments have been conducted for the oceans (Singh et al., 2018), energy systems (Nerini et al., 2018), eliminating hunger (Rasul, 2016; ICSU, 2017), increasing human health (Bekker et al., 2018), and more general SDG areas of interest (Pradhan et al., 2017). Importantly, however, general knowledge on linkages is not enough to guide a transition to sustainability without deeper information on the scale of change needed to achieve particular or multiple targets (Singh et al., 2021).

Besides the diversity of sustainable development dimensions, governing coastal regions has to contend with existing governance systems that are built on quasi-non-overlapping

jurisdictions. Governments and industries are highly siloed, where different sectors of the economy are regulated and acted on by distinct organizations (Halpern et al., 2008). For example, most governments have distinct regulatory organizations that deal with oceans versus terrestrial lands, and between fisheries and farming, even though these different sectors are highly related (Cottrell et al., 2018). Beyond the fragmentation of governance along lines of economic sectors, there are often jurisdictional distinctions between national government and subnational government agencies. For example, to address issues of marine pollution in British Columbia, Canada, a successful initiative would likely need to work between Fisheries and Oceans Canada (a federal department regulating fisheries) Transport Canada (a federal department regulating shipping), Agriculture Canada (a federal department regulating agricultural production), the Ministry of Agriculture (a provincial ministry regulating agricultural lands and production), local government planning organizations, and others.

We propose a framework built on the theoretical perspectives of policy coherence and sustainable transitions. In so doing, we have created a framework that operates across three dimensions; horizontal policy coherence; vertical policy coherence, and programmatic alignment. Policy coherence is theoretically an attribute of policy that systematically reduces conflict and promotes synergies between and within different policy actors and institutions to achieve the outcomes associated with agreed policy objectives (Nilsson et al., 2012). Specifically, working across agencies and organizations that operate at the same scale (e.g., national) is often called "horizontal policy coherence" whereas working across agencies that operate across different scales (e.g., between national and sub-national) is often referred to as "vertical policy coherence" (Nilsson et al., 2012).

Horizontal and vertical policy coherence across agencies needs to consider the programmatic alignment from vision to implementation. To address programmatic alignment, we relied on theoretical framing of sustainability transitions, specifically transition management theory. The literature on societal change and governance systems to promote sustainability identify three governance levels to consider: (1) the strategic level of vision development and goal setting; (2) the tactical level of institutional interactions; (3) the operational level of implementation (Loorbach, 2010; Singh, 2020). Where organizations have disjoint governance actions across these three levels, any sustainability initiatives my fail. For example, if an environmental NGO and a community-based organization share broad goals of ocean conservation, but the local group is not included in decisions and responsibilities of setting up an MPA, the MPA may suffer from a lack of local-buy-in and enforcement, especially if the local group supports alternative conservation actions (Christie, 2004). This governance approach – alignment across sectoral (horizontal), policy resolution (vertical) and policy actors (from goals to institutions and operations) – can be a useful approach to integrate systems analysis into planning (**Figure 1**).

The relationship among these three scales can help determine appropriate policy strategies to achieve sustainable development (Kemp et al., 2007; Loorbach, 2010), as understanding how various dimensions of sustainable development are related to each other (strategic actions), can inform how to structure governance institutions, and the way that governance institutions are structured (tactical actions) can realize which relationships among sustainable development dimensions are achievable and which ones are not. The types of institutions and their relationships to each other also regulates the policy interventions that can be undertaken (operational actions), while identifying effective interventions can determine new potential collaborations between institutions. This model is structured to align governance coherence both from top-down and bottom-up perspectives. Top down processes would help structure and steer activities that occur below, while bottom up processes would instruct higher levels about the effectiveness of projects and policies. This kind of reflexive feedback allows for self-correction in governance structure and treats the process of achieving sustainable development as a complex adaptive system (Kemp et al., 2007; Loorbach, 2010). Below, we provide four case studies of land-sea governance problems that explore these situations. We detail case studies across a range of countries – including small island states, a developing coastal country, and a developed coastal country – to document the diversity of settings that can benefit from the approach outlined here.

CASE STUDIES

Case Study 1: Planning Institutional Network to Support Sustainability Goals in Aruba – Using the Strategic Scale to Inform the Tactical Scale

Problem Context

Aruba is a small island state in the southern Caribbean, with 90% of annual GDP is derived from coastal tourism (WTTC, 2019). A large proportion of Aruba's island surface has been transformed for tourism infrastructure (Barendsen et al., 2008). Aruba's coastal development to date has led to marine pollution problems as well as coastal habitat loss, such as through mangrove removal (Oduber et al., 2015). Though marine tourism has such high economic value, it is not necessarily sustainable and it does not focus on a healthy marine ecosystem but rather having warm, clean, sand beaches (Singh et al., 2021). Aruban institutions responsible for managing the land-sea interface within Aruba operate in a siloed fashion, and initiatives from some may counteract the goals of others (Singh et al., 2021). For example, much of the pollution problems come from coastal and community development, which are regulated by the Aruba Tourism Agency and Department of Economic Affairs and Infrastructure, who promote coastal tourism and development. Yet, tourism is also dependent on clean waters, so regulating marine pollution is beneficial, and requires alignment among agencies that can help regulate pollution.

The Sustainable Development Objective

Aruba has a SDG commission which indicated that SDG 14 (Life Below Water – the Ocean Goal) is a priority for the island state, and hosted a workshop to determine policy priorities

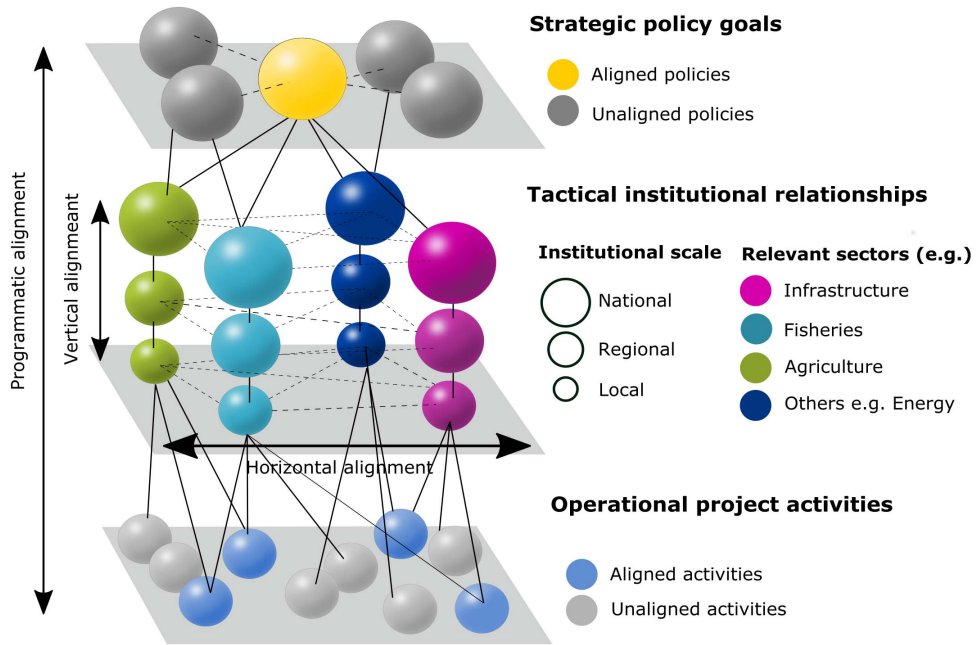

FIGURE 1 | A framework for aligning governance actors and activities for sustainability in land-sea interfaces. This framework considers programmatic alignment (connections between strategic, tactical, and operational components), vertical alignment (connections between tactical institutions acting at different scales), and horizontal alignment (connections within components at the same governance level). Unaligned activities are those which are not connected across all three types of alignment (programmatic, vertical, horizontal).

to achieve sustainable oceans (Singh et al., 2021). Through an SDG interrelationship exercise, SDG 14.1, the target to reduce marine pollution, was determined to be the SDG target that was a pre-requisite across the largest number of SDG ocean targets. Consequently, it was found to be the most important pre-requisite for achieving the largest number of other SDG targets across ocean targets. Determining how to achieve the target of reducing marine pollution, and what actors are needed to work together to achieve it, can be seen as a priority for the small island nation.

Planning Vertical and Horizontal Coherence at the Tactical Scale to Meet Priorities at the Strategic Scale

With a priority target determined, workshop participants conducted another SDG interrelationship exercise, this time to look at what SDG targets promote or detract from achieving SDG 14.1: reducing marine pollution. This exercise was done to explore the multiple policy options and determine the policy requirements needed to effectively manage marine pollution. In effect, this exercise explored the Strategic scale of the transition management framework. Results for this exercise are presented in **Table 1**.

With the interlinkages supporting SDG 14.1 determined across the land-sea interface, workshop participants could make informed recommendations of how Aruban institutions should be structured in order to take advantage of the identified co-beneficial relationships (exploring the tactical scale of transition management framework). First, participants created a scenario where only direct institutional regulation for SDG achievement is considered (SDG interactions do not shape the structure of institutions). Second, participants created a scenario whereby the collaborative structure of institutions was guided by SDG interlinkages that support the achievement of SDG 14.1 (as well as the SDG target that posed a potential trade-off with SDG 14.1). In the first scenario, participants determined six Aruban agencies that collaborate to work toward SDG 14.1, including the Directorate of Nature and Environment (DNE), and all six equally collaborate (determined by the number of links with other institutions, **Figure 2**). However, when SDG interlinkages were considered to support SDG 14.1, a more complex institutional network was produced (**Figure 2**). In this scenario, the three most important Aruban agencies (in order, according to centrality measures) were the Social and Economic Council (SEC), the Department of Economic Affairs (ECO), and the Aruba Tourism Authority (ATA, **Figure 2**), while the DNE was connected to fewer institutions and so might be less influential in coordinating actions across institutions.

Case Study 2: Land-Sea Co-benefits of Climate-Smart Agriculture – Using the Operational Scale to Inform the Tactical Scale

Problem Context

Dominica is a small Caribbean island state that has historically relied heavily on agricultural production for its economy – agriculture has represented 12–16% of total GDP since 2010 (Worldbank, 2021) – and over 60% of the population live in

the coastal zone. As the northernmost of the eastern windward islands, Dominica's location exposes it to a range of natural hazards, particularly hurricanes and tropical storms (Barclay et al., 2019). Extreme weather has had a huge influence on natural resource use on the island and has shown capacity for shifting livelihood activities from farming to fishing when agricultural shocks occur (Ramdeen et al., 2014; Cottrell et al., 2019). Banana production has been the dominant crop in Dominica throughout the 1900s (Barclay et al., 2019) but the vulnerability of monocrop dependence has been highlighted by two notable events – Hurricane David in 1979 which led to sudden and widespread crop damage, and the dissolution of historical trade deals with the EU in the 1990s which resulted in a steady decline of banana production (Cottrell et al., 2019). On both occasions, rapid increases in fisheries landings occurred following agricultural collapse, and after Hurricane David these fishing surges were followed by sudden declines in catch thought to be linked to overfishing in nearshore waters (Cottrell et al., 2019). Dominica has committed to protecting "Life below water" (SDG14) through reducing overcapacity, bycatch and discards, and unregulated fishing (SDG 14.2 and 14.4) and increasing marine protected areas (SDG14.5) through its partnership in the Western Central Atlantic Fisheries Commission. However, continuing to meet these targets will require strengthening the resilience of the agricultural systems to guard against such unpredictable shifts between sectors under a future of projected increasing volatility.

TABLE 1 | The SDG targets determined to contribute to (or detract from) the achievement of SDG 14.1 in Aruba.

SDG target	Description	Interrelationship type
6.3	Wastewater management	Prerequisite co-benefit
12.5	Reduction in waste generation	Prerequisite co-benefit
11.4	Protect cultural and natural heritage	Prerequisite co-benefit
12.4	Environmentally sound management of chemicals and waste	Prerequisite co-benefit
9.4	Retrofit industry infrastructure for sustainability	Prerequisite co-benefit
11.6	Reduce per-capita impact of cities	Prerequisite co-benefit
17.14	Assist developing countries in attaining long term debt sustainability	Prerequisite co-benefit
8.4	Improve resource efficiency in economic growth	Prerequisite co-benefit
13.2	Integrate climate change measures into national planning	Prerequisite co-benefit
17.17	Transfer of environmentally sound technologies to developing countries	Potential co-benefit
13.1	Strengthen adaptive capacity to climate-related hazards	Potential co-benefit
8.2	Economic diversification and technological upgrading and innovation	Potential co-benefit
16.4	Combat organized crime	Potential co-benefit
16.10.	Public access to information	Potential co-benefit
13.3	Improve education on climate change mitigation	Potential co-benefit
10.1	Sustain income growth of bottom 40%	Potential trade-off

The targets are shown in descending order of certainty among the workshop participants who determined the linkages from the SDGs to the SDG 14 targets.

The Sustainable Development Objective

Dominica is already in an extraordinary position for transition in its agricultural sector. Following the damage of Hurricane Maria in 2017, the Dominican government published the Emergency Agricultural Livelihoods and Climate Resilience Project [Government of the Commonwealth of Dominica (GCD), 2018]. The government has committed US $16.5 million toward the DEALCRP to restore a productive base for crop- and livestock-based livelihoods and business. However, executing the DEALCRP successfully requires coherence between government and non-governmental actors, which our framework can help with.

Planning Vertical and Horizontal Coherence at the Tactical Scale to Carry Out a Project at the Operational Scale

Referencing key environmental and social challenges for agricultural resilience documented in the DEALCRP as well as peer reviewed literature, we outline how agroforestry (the co-cultivation of crops with shade trees) can work toward mitigating these challenges (planning on the operational scale), and link these elements of an agroforestry program to the governance institutions that are needed to work together to effectively carry out this program (the tactical scale). We also outline anticipated SDG co-benefits of successfully implementing agroforestry in Dominica (**Figure 3**).

Food resource productivity and livelihood vulnerabilities on Dominica are driven by numerous factors. High dependence on a single crop is reinforced by the rapid recovery time bananas can provide after disaster combined with economic incentives for regrowth from the windwards island insurance scheme and the productivity of the crop itself (Mohan, 2017b). Banana crops are known to be more susceptible than many other crops to wind damage, with root dislocation and moisture stress possible even in weak tropical storms (Mohan, 2017a). Dominica's mountainous terrain is also challenge for cultivation in places, with soil erosion during times of heavy rainfall leading to landslides and flooding, and there is recognition of the need for greater soil stabilization than current management practices provide [Government of the Commonwealth of Dominica (GCD), 2018]. These factors are all in addition to Dominica's vulnerability from its physical position in the Caribbean.

Yet integrating bananas into an agroforestry setting could reduce many of these vulnerabilities while delivering multiple co-benefits. Banana agroforestry with fig, mango and Albizia species (for timber) have shown great promise for increasing soil fertility in Uganda, for example (Ssebulime et al., 2019). Shade trees provide sources of income from timber (even after storm damage) and fruits throughout the year, and leaf litter for compost reducing the need for agrochemicals. Similar benefits from livelihood diversification have been demonstrated when growing bananas alongside coffee too (Reay, 2019). If combined with silvopastoral practices (livestock integrated into fruit and timber trees), livestock provide another income stream and

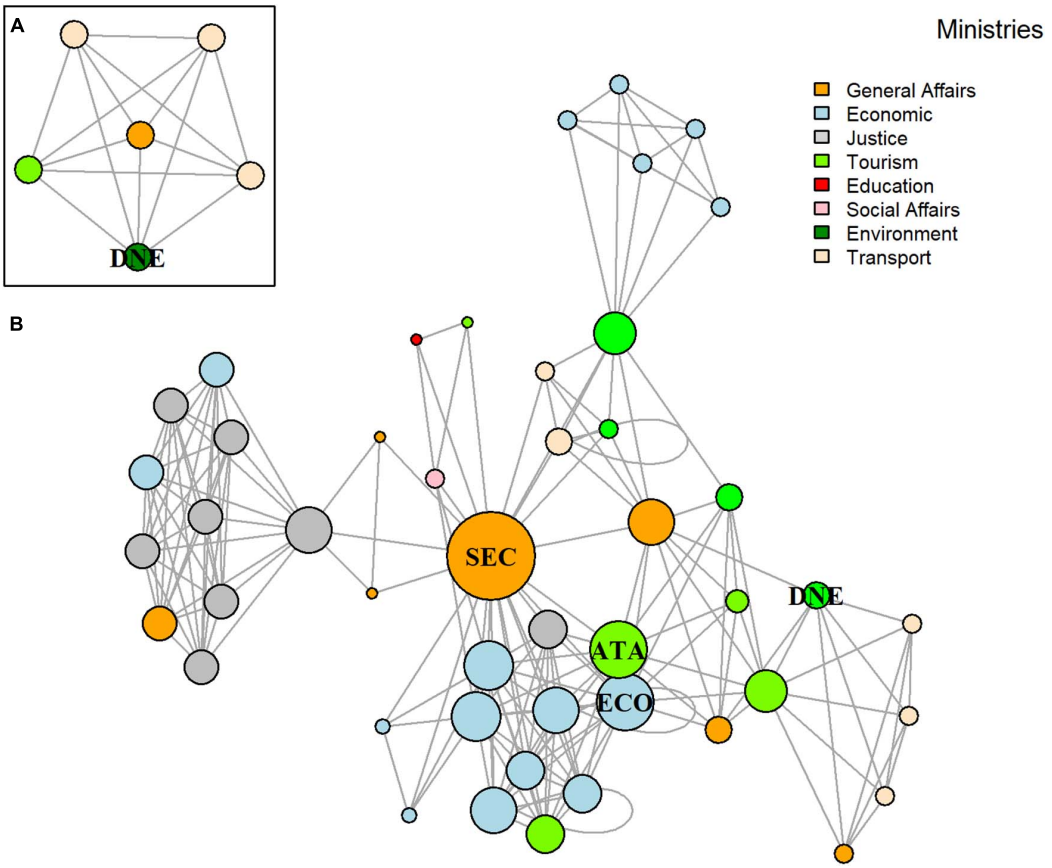

FIGURE 2 | Network diagrams of the institutional structures needed to manage SDG 14.1, considering only direct regulation management **(A)**, and considering all SDG targets that contribute to SDG 14.1, with the institutions that manage these supportive SDG targets **(B)** for Aruba. When only direct regulation is considered, few institutions have an equal role in achieving the SDG target, including the Directorate of Nature and the Environment (DNE). When interlinkages are recognized between SDG targets then more institutions are involved in achieving the SDG target and some have a more central role in coordinating policy and action. In the case of achieving SDG 14.1 for Aruba, this includes the Social and Economic Council (SEC), the Department of Economic Affairs (ECO), and the Aruban Tourism Authority (ATA). Institutions are clustered based on their association among other institutions, and links vary in length based on the distance between institutions they are connecting.

a source of manure (Waldron et al., 2017). Agroforestry can increase above and below ground biomass, reducing surface run-off and binding soils together while buffering the standing crops' exposure to high winds during a storm (Waldron et al., 2017). Forested areas are already recognized for their importance in erosion control in Dominica [Government of the Commonwealth of Dominica (GCD), 2018], so spreading these benefits into food production systems suffering from soil erosion problems is a logical step. In making agricultural systems more resilient in the face of meteorological shocks, Dominica can prevent unpredictable shifts in resource use seen in recent years that threaten marine sustainability targets (SDG 14). But in doing so also generates co-benefits among multiple goals for poverty and hunger reduction (SDG1 and 2), economic development (SDG 8), responsible production and consumption (SDG12) and reduces terrestrial habitat fragmentation with numerous benefits for wildlife (SDG 15) (**Figure 3**).

Successfully realizing these benefits will require effective collaboration among divisions of the Ministry of Blue & Green Economy, Agriculture and National Food Security (MEAF), and the Ministry of Environment Climate Resilience, Disaster Management and Urban Renewal (MECDU), as well as the many private small-scale landowners who engage in agriculture. For the Division of Agriculture in the MEAF, a shift toward agroforestry aligns strongly with its Coffee and Cocoa program which is currently rehabilitating existing plantations, and expanding production over the island to meet objectives of increasing exports, income, and employment (Division of Agriculture, 2021). Close communication with the Forestry, Parks, and Wildlife Division within MEDU would be needed at a number of levels. Firstly, to ensure that suitable companion crops could be grown alongside bananas and that timber resources were able to be optimally utilized within State and private lands. Indeed, current operations to thin State forests provide an opportunity to enrich existing plantations with diverse and profitable fruit crops (Division of Forestry, Parks, and Wildlife, 2021). Second, to ensure agroforestry expansion was attractive, profitable, and feasible for private landowners in parallel with

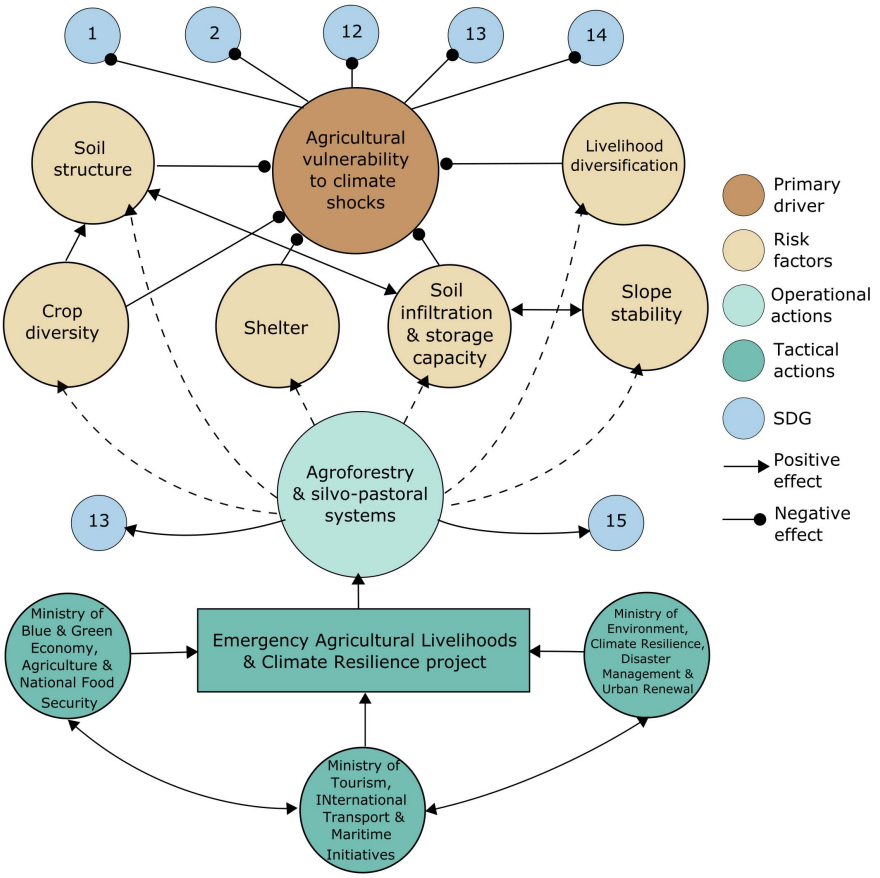

FIGURE 3 | The role of agroforestry for addressing land-sea switches and sustainability in Dominica. With agricultural vulnerability to climate shocks identified as the primary driver of challenges to sustainable development goals, we show how agroforestry at the operational scale can directly and indirectly address sustainability challenges and inform tactical institutional collaboration.

existing responsibilities of the FWPD's silviculture unit. Third, FWPD's aims to minimize soil erosion and maximize the value of forestry units for wildlife refugia could be tracked alongside monitoring agroforestry productivity.

Further, such integrative farming practices can be a feature of agro- and ecotourism programs rather than seen as a source of conflict, enhancing their economic potential (Hakim et al., 2019) and highlighting the need for collaboration with the Ministry of Tourism, International Transport, and Maritime activities[1]. Finally, effective temporal tracking of livelihood mobility between agriculture and fisheries during new fisher registration and agricultural surveys will be necessary for empirical evidence of changes in agricultural resilience through time, and will require efficient data sharing among agriculture and fisheries divisions of the MEAF. By addressing the major challenges that face agriculture and identifying a solution that strengthens and aligns current programs to meet environmental and social objectives – promoting widespread agroforestry as a key operational activity can inform necessary tactical design for effective land-sea governance in Dominica.

[1]https://tourism.gov.dm/

Case Study 3: Developing a Common Strategy for the Great Barrier Reef From Diverse Management Agencies – Using the Tactical Scale to Inform the Strategic Scale

Problem Context

Australia's Great Barrier Reef is managed by agencies at federal and state levels, whose strategic goals for the reef do not always align. Some agencies have a clear preservationist conservation mandate while others are interested in promoting development opportunities (**Table 2**). While management agencies can potentially find an acceptable balance between these two goals, in practice, conflicting management and trade-offs occur. The Great Barrier Reef Marine Park Authority (GBRMPA), is the federal agency primarily responsible for managing, zoning, and permitting activities related to the reef since 1975 (Day and Dobbs, 2013). The Great Barrier Reef was designated as a UNESCO World Heritage Area in 1981 and the federal marine park covers 99% of the Great Barrier Reef Region, while the remaining 1% is under the jurisdiction of The State of Queensland (Day and Dobbs, 2013).

Beyond the boundaries of the GBR, including the larger land-sea interface, growth in mining and industry have led to an increase in development of ports and shipping, managed by the Department of Infrastructure, Transport, Cities, and Regional Development (**Table 2**). Recent proposals for development of coal mines and adjacent ports within the Great Barrier Reef Marine Park (GBRMP) have been met with opposition by scientists who suggest that such development would lead to an increase in both locally derived water quality issues as well as contributing to climate change by further development of fossil fuels (Hughes et al., 2017). The biggest local threat to the inshore reef is water quality (MacNeil et al., 2019), while the greatest overall threats are related to climate change – causing increased water temperatures and bleaching events – which are global in nature and require high level action and international cooperation to address them (Hughes et al., 2017). Much of the water pollution is related to catchment runoff from adjacent sugar cane farms which lead to increased sediment, nutrient, and pesticide loads to the GBRMP (MacNeil et al., 2019). The State of Queensland manages water quality that flows to the Great Barrier Reef, and has targets to reduce sediment and nutrient loads in their draft water quality improvement plan for 2017–2022 (Queensland, 2017).

The Sustainable Development Objective

The conflicting priorities among agencies managing the GBR are a direct result of the conflicting strategic directions of unaligned institutions. Activities in the Great Barrier Reef are regulated by complimentary legislation and joint field management, and permits between federal and state governments (Day and Dobbs, 2013; **Table 2**). The GBRMPA employs a multiple-use marine spatial zone to separate conflicting activities.

In order for the Great Barrier Reef to persist into the future (SDG 14) and keep some development and conservation opportunities available (SDG 8), better alignment among regulatory bodies will be needed. In other words, for the strategic goals to be achievable and not contradictory, the tactical systems that support it need to be complementary.

Arriving at a Cohesive Overall Goal at the Strategic Scale Through Shared Planning at the Tactical Scale

A major conservation challenge identified by the GBRMPA and affiliated institutions concerns the synergistic impacts among ocean warming, the subsequent increased frequency of bleaching events, and the disproportionate impacts these events have on reefs with poor local water quality. While addressing climate change impacts of ocean warming are beyond the sole capacity of federal and state agencies, addressing water quality issues will require cooperation between The State of Queensland and the GBRMPA as well as discussion about the types of land-based industries and activities that are compatible with minimizing impacts on the Great Barrier Reef (**Table 2**). Concessions by the agricultural and mining industries will undoubtedly need to be made to mitigate impacts on the Great Barrier Reef and the associated tourism industry, requiring high level vision at the strategic scale to steer the development of these industries. At the same time, mining and agriculture cannot be expected to end in the region. Instead, shared planning processes between the GBRMPA, state agencies, and mining and agriculture agencies can determine priority areas and activities for different land-and-sea uses (**Table 2**).

Given the often competing interests of the regulatory bodies, it might be helpful to identify a common shared vision that all agencies can contribute to. Using a structured decision-making process, all relevant agencies and stakeholders can develop a common understanding of how the system operates, propose a series of alternative development trajectories (and associated consequences), and evaluate trade-offs of various scenarios (Gregory et al., 2012). Though the likelihood that any resulting plan will fully satisfy all stakeholders is minute, research indicates that stakeholders who participate in planning processes generally consider the resulting decisions as more legitimate as those who do not (Jentoft, 2000).

Case Study 4: Planning a Way to Address Illegal Fishing for Mexican Small Scale Fisheries – Using Operational Challenges to Inform the Tactical and Strategic Scales

Problem Context

Santa Cruz de Miramar, Mexico, is a community of around 1500 people and is economically dependent on a variety of coastal industries, including coastal tourism and artisanal fishing. It is the largest producer of oysters in the state, and a co-management scheme with a local cooperative of around 70 licensed fishers is responsible for much of the fishery. The cooperative was set up in the 1920s, and though it was weakened during a strong neoliberal push in the 1990s (Basurto et al., 2013), it is being strengthened again, aided by local researchers and NGOs. However, despite the recent gains in local management capacity, the fishery has faced a number of challenges that local institutions cannot respond to, namely overharvesting, poaching, and sales of illegally fished product.

The Sustainable Development Objective

The problems with particular fisheries management programs (operational scale) – namely the enforcement of illegal fishing – was evaluated to look for ways in which institutional roles and collaboration (the tactical scale) and changes to broad policy along the land-sea interface (the strategic scale) could provide solutions (De la Cruz-González et al., 2018).

Organizing Institutional Actors in the Tactical Scale and Re-evaluating the Goals of the Strategic Scale to Address Programs at the Operational Scale

To understand the causes and potential solutions around this problem, the cooperative partnered with the National Fisheries Institute (INAPESCA, the science branch of the federal fisheries management in Mexico) to undertake research to inform management strategy and coordination. This included mapping local oyster beds and analyzing population structures and market dynamics, which led to the implementation of individual daily allowable catches, minimum size limits, bed rotations and seasonal closures. This is all implemented, monitored, and

enforced by the cooperative itself, including setting punishments for members who break rules, and evidence to date shows significant increases in catch and in value due to larger sizes and harvest timed to coincide with higher seasonal prices (De la Cruz-González et al., 2018).

As part of a SWOT (strengths, weaknesses, opportunities, threats) analysis of the oyster fishery (De la Cruz-González et al., 2018), local fishers identified "unclear institutional mandates and obligations" as a major weakness of the fishery. Cooperative fishers perceive federal institutions as responsible for regulatory services, including researching the status of local stocks and issuing fishing licenses. State agencies are perceived as operational agents, financing projects and monitoring quality controls. Local authorities are perceived as monitoring and responding to illegal fishing and preventing sales of illegally caught seafood, with a narrow scope but essential tactical actions. Local authorities, therefore, are perceived to be responsible for factors they have little capacity to resolve, and which state and federal agencies are mandated to address (i.e., issues of enforcement and organized crime). There are similar examples from around the world that show this type of interplay, where tactical and strategic levels of management operate (or are perceived to operate) almost independently of each other despite obvious overlaps in general goals. An active role of fishers and community leaders is crucial for propelling local sustainability actions but can be challenged by a lack of support or at least tacit approval of higher-level governance institutions. There is an increasingly strong and cross-scale movement to strengthen governance in support of artisanal fishers [Food and Agriculture Organization (FAO), 2015], and a key component is a greater willingness of governments and institutions to share and devolve management power to communities, recognizing unique contexts that require unique knowledge and solutions even within broader national goals (Lozano et al., 2019).

While most current attention for sustainable fisheries is focused on SDG 14 at a strategic scale (ensuring suitable conditions to promote life below water and manage extraction), it is clear that fisheries-related issues often have ultimate causes well beyond the purview of fisheries managers. In the case study presented here, two key additional strategic topics were recognized as important to address fishery sustainability (De la Cruz-González et al., 2018). First, increasing coastal development and pollution from increasing tourism and urbanization are posing a risk to fishery productivity. Second, the lack of employment alternatives and lack of access to wider seafood markets leads to greater pressure on local fish stocks. In the specific context of the SDGs, continued fishery sustainability (SDG 14) would benefit from a greater integrated strategy designed to promote the co-benefits and avoid trade-offs with coastal development (SDG 9), sewage treatment (SDG 6), urban design (SDG 11), and economic opportunities (SDG 8). Because none of these issues are within the purview of fisheries management institutions, interfacing across institutions is evidently critical for success and this can indeed build on the SDGs themselves (Singh et al., 2021).

TABLE 2 | Agencies, their scale of operation, and stated priorities relevant to the management of the Great Barrier Reef (GBR).

Agency	Scale of operation	Stated priorities relevant to GBR
Great Barrier Reef Marine Park Authority	Federal	Care and protection of the Great Barrier Reef Marine Park – issues permits for various forms of use of the marine park, and monitors usage in the park to ensure compliance with rules and regulations
State of Queensland – Economic Development	State	Specialist land use planning and property development unit – works with local governments, industry, and the community to identify growth opportunities
Department of Sustainability, Environment, Water, Population, and Communities	Federal	Regulation of activities including world heritage values
Queensland Parks and Wildlife Service	State	Protect and manage Queensland's parks, forests and the Great Barrier Reef
United Nations Educational, Scientific, and Cultural Organization World Heritage Site Status	International	Legally protected by international treaties and labelled as a protected zone
Australian Fisheries Management Authority	Federal	Management and sustainable use of fisheries resources
Department of Infrastructure, Transport, Cities, and Regional Development	Federal	Regulatory framework for shipping and environmental and safety regulation

Stated priorities were obtained from relevant organizational websites.

CONCLUSION

Promoting sustainable development at the land-sea interface requires a coordinated governance structure that can effectively regulate and act within complex social-ecological systems. Achieving this coordination requires a systematic framework to align strategic priorities, tactical organization, and operational programming. Such a framework provides opportunities for both researcher and policymakers to engage in the process of sustainable development: for researchers it sets out particular research questions around particular planning scales (such as determining how goals fit together at the strategic scale, or evaluating the feasibility of promised activities given the institutional network supporting it at the operational and tactical scales). This research can build on innovative methods used to track relationships between sustainability goals, such as the Sustainable Development Goals. For policymakers, the benefit of the framework is structuring decisions at key governance levels and designing policy and programs that will minimize counterproductive activities and maximize chances of success. Despite the potential of this framework, it has not been formally tested. Though we explore four case studies using the framework

in this study, this study is limited by retroactively interpreting cases through the lens of the framework. Future studies to develop this work should use this framework in active governance planning processes. Here, we propose the use of this framework for complex governance problems such as in the Great Barrier Reef – this case may benefit from a process guided by this approach, which would be timely given the multiple issues the region faces. Beyond this case, explicitly focusing on the alignment of various levels of governance scales can be applied across contexts, including in strategic planning and program development in Small Island Developing States, iconic marine areas in the world's most developed countries, and fishing communities in coastal developing nations. Research and policy developed with such a governance framework can be particular important for coastal systems, which are arguably the most complex social-ecological systems on earth, and which are so important to achieve the Sustainable Development Goals.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

GS conceived of the manuscript. GS and RC created the figures. All authors wrote the manuscript, and each author contributed one case study.

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REFERENCES

Barclay, J., Wilkinson, E., White, C. S., Shelton, C., Forster, J., Few, R., et al. (2019). Historical trajectories of disaster risk in Dominica. *Int. J. Disaster Risk Sci.* 10, 149–165. doi: 10.1007/s13753-019-0215-z

Barendsen, P. B., Boekhoudt, B., Boekhoudt, G., Carrillo, L., Derix, R., Franken, F., et al. (2008). *WildAruba Conservation Planning Workshop Final Report*. Apple Valley,MN: IUCN/SSC Conservation Breeding Specialist Group.

Basurto, X., Bennett, A., Weaver, A. H., Dyck, S. R. V., and Aceves-Bueno, J. S. (2013). Cooperative and noncooperative strategies for small-scale fisheries' self-governance in the globalization era: implications for conservation. *Ecol. Soc.* 18:38.

Bekker, L.-G., Alleyne, G., Baral, S., Cepeda, J., Daskalakis, D., Dowdy, D., et al. (2018). Advancing global health and strengthening the HIV response in the era of the Sustainable Development Goals: the International AIDS Society—Lancet Commission. *Lancet* 392, 312–358.

Bennett, N. J., Blythe, J., Cisneros-Montemayor, A. M., Singh, G. G., and Sumaila, U. R. (2019). Just transformations to sustainability. *Sustainability* 11:3881. doi: 10.3390/su11143881

Blanchard, J. L., Watson, R. A., Fulton, E. A., Cottrell, R. S., Nash, K. L., Bryndum-Buchholz, A., et al. (2017). Linked sustainability challenges and trade-offs among fisheries, aquaculture and agriculture. *Nat. Ecol. Evol.* 1, 1240–1249. doi: 10.1038/s41559-017-0258-8

Blythe, J., Silver, J., Evans, L., Armitage, D., Bennett, N. J., Moore, M. L., et al. (2018). The dark side of transformation: latent risks in contemporary sustainability discourse. *Antipode* 50, 1206–1223. doi: 10.1111/anti.12405

Broman, G. I., and Robèrt, K.-H. (2017). A framework for strategic sustainable development. *J. Clean. Prod.* 140, 17–31.

Christie, P. (2004). Marine protected areas as biological successes and social failures in Southeast Asia. *Am. Fish. Soc. Symp.* 42, 155–164

Cottrell, R. S., Fleming, A., Fulton, E. A., Nash, K. L., Watson, R. A., and Blanchard, J. L. (2018). Considering land–sea interactions and trade-offs for food and biodiversity. *Glob. Chang. Biol.* 24, 580–596. doi: 10.1111/gcb.13873

Cottrell, R. S., Nash, K. L., Halpern, B. S., Remenyi, T. A., Corney, S. P., Fleming, A., et al. (2019). Food production shocks across land and sea. *Nat. Sustain.* 2, 130–137. doi: 10.1038/s41893-018-0210-1

Day, J. C., and Dobbs, K. (2013). Effective governance of a large and complex cross-jurisdictional marine protected area: australia's Great Barrier Reef. *Mar. Policy* 41, 14–24. doi: 10.1016/j.marpol.2012.12.020

De la Cruz-González, F. J., Patiño-Valencia, J. L., Luna-Raya, M. C., and Cisneros-Montemayor, A. M. (2018). Self-empowerment and successful co-management in an artisanal fishing community: santa Cruz de Miramar, Mexico. *Ocean Coast. Manag.* 154, 96–102. doi: 10.1016/j.ocecoaman.2018.01.008

Division of Forestry, Parks, and Wildlife (2021). *Forestry, Wildlife and Parks Division* Available online at: https://forestry.gov.dm/ (accessed May 14, 2021).

Government of the Commonwealth of Dominica [GCD]. (2018). *Dominica Emergency Agricultural Livelihoods and Resilience Project Environmental and Social Management Framework (ESMF)*, Queensland: Department of Agriculture, And Fisheries.

Food and Agriculture Organization [FAO]. (2015). *Voluntary Guidelines For Securing Sustainable Small-Scale Fisheries In The Context Of Food Security And Poverty Eradication*. Rome: Food and Agriculture Organization.

Gregory, R., Failing, L., Harstone, M., Long, G., Mcdaniels, T., and Ohlson, D. (2012). *Structured Decision Making: A Practical Guide To Environmental Management Choices*. Hoboken: John Wiley & Sons.

Hakim, L., Siswanto, D., Rahardi, B., and Zayadi, H. (2019). Fostering coffee agroforestry for agrotourism development in degraded land in a buffer zone of a national park: a case study from Poncokusumo, Malang, Indonesia. *EurAsian J. BioSci.* 13, 1613–1620.

Halpern, B. S., Frazier, M., Potapenko, J., Casey, K. S., Koenig, K., Longo, C., et al. (2015). Spatial and temporal changes in cumulative human impacts on the world's ocean. *Nat. Commun.* 6:7615.

Halpern, B. S., Mcleod, K. L., Rosenberg, A. A., and Crowder, L. B. (2008). Managing for cumulative impacts in ecosystem-based management through ocean zoning. *Ocean Coast. Manag.* 51, 203–211. doi: 10.1016/j.ocecoaman.2007.08.002

Hughes, T. P., Barnes, M. L., Bellwood, D. R., Cinner, J. E., Cumming, G. S., Jackson, J. B., et al. (2017). Coral reefs in the Anthropocene. *Nature* 546, 82–90.

ICSU (2017). *A Guide To SDG Interactions: From Science To Implementation*. International Council for Science, Paris.

Jentoft, S. (2000). Legitimacy and disappointment in fisheries management. *Mar. Policy* 24, 141–148. doi: 10.1016/s0308-597x(99)00025-1

Kemp, R., Loorbach, D., and Rotmans, J. (2007). Transition management as a model for managing processes of co-evolution towards sustainable development. *Int. J. Sustain. Dev. World Ecol.* 14, 78–91. doi: 10.1080/13504500709469709

Lam, V. W., Allison, E. H., Bell, J. D., Blythe, J., Cheung, W. W., Frölicher, T. L., et al. (2020). Climate change, tropical fisheries and prospects for sustainable development. *Nat. Rev. Earth Environ.* 1, 440–454.

Loorbach, D. (2007). *Transition management. New mode of governance for sustainable development*. Utrecht: International Books.

Loorbach, D. (2010). Transition management for sustainable development: a prescriptive, complexity−based governance framework. *Governance* 23, 161–183. doi: 10.1111/j.1468-0491.2009.01471.x

Lotze, H. K., Lenihan, H. S., Bourque, B. J., Bradbury, R. H., Cooke, R. G., Kay, M. C., et al. (2006). Depletion, degradation, and recovery potential of estuaries and coastal seas. *Science* 312, 1806–1809. doi: 10.1126/science.1128035

Lotze, H. K., Tittensor, D. P., Bryndum-Buchholz, A., Eddy, T. D., Cheung, W. W., Galbraith, E. D., et al. (2019). Global ensemble projections reveal trophic amplification of ocean biomass declines with climate change. *Proc. Natl. Acad. Sci.U. S. A.* 116, 12907–12912.

Lozano, A. G., Smith, H., and Basurto, X. (2019). Weaving governance narratives: discourses of climate change, cooperatives, and small-scale fisheries in Mexico. *Marit. Stud.* 18, 77–89. doi: 10.1007/s40152-018-0125-5

MacNeil, M. A., Mellin, C., Matthews, S., Wolff, N. H., Mcclanahan, T. R., Devlin, M., et al. (2019). Water quality mediates resilience on the Great Barrier Reef. *Nat. Ecol. Evol.* 3, 620–627.

Division of Agriculture. (2021). *Division of Agriculture* [Online]. Available: http://divisionofagriculture.gov.dm/ (accessed May 14, 2021).

Mohan, P. (2017b). The economic impact of hurricanes on bananas: a case study of Dominica using synthetic control methods. *Food Policy* 68, 21–30. doi: 10.1016/j.foodpol.2016.12.008

Mohan, P. (2017a). Impact of hurricanes on agriculture: evidence from the Caribbean. *Nat. Hazards Rev.* 18:04016012. doi: 10.1061/(asce)nh.1527-6996.0000235

Nerini, F. F., Tomei, J., To, L. S., Bisaga, I., Parikh, P., Black, M., et al. (2018). Mapping synergies and trade-offs between energy and the Sustainable Development Goals. *Nat. Energy* 3, 10–15.

Nilsson, M., Chisholm, E., Griggs, D., Howden-Chapman, P., Mccollum, D., Messerli, P., et al. (2018). Mapping interactions between the sustainable development goals: lessons learned and ways forward. *Sustain. Sci.* 13, 1489–1503. doi: 10.1007/s11625-018-0604-z

Nilsson, M., Zamparutti, T., Petersen, J. E., Nykvist, B., Rudberg, P., and Mcguinn, J. (2012). Understanding policy coherence: analytical framework and examples of sector–environment policy interactions in the EU. *Environ. Policy Gov.* 22, 395–423. doi: 10.1002/eet.1589

Nordhaus, I., Roelke, D. L., Vaquer-Sunyer, R., and Winter, C. (2018). *Coastal Systems In Transition: From A 'Natural'to An 'Anthropogenically-Modified'state*. Amsterdam: Elsevier.

Oduber, M., Ridderstaat, J., and Martens, P. (2015). The connection of vegetation with tourism development and economic growth: a case study for Aruba. *J. Environ. Sci. Eng.* 4, 420–431.

Pradhan, P., Costa, L., Rybski, D., Lucht, W., and Kropp, J. P. (2017). A systematic study of Sustainable Development Goal (SDG) interactions. *Earths Future* 5, 1169–1179. doi: 10.1002/2017ef000632

Queensland. (2017). *Draft Reef 2050 Water Quality Improvement Plan 2017-2022 for Public Consultation*. Queensland: Queensland Government

Ramdeen, R., Harper, S., and Zeller, D. (2014). "Reconstruction of total marine fisheries catches for Dominica (1950-2010)," in *Fisheries Catch Reconstructions, Part IV*, eds K. Zylich, D. Zeller, M. Ang, and D. Pauly (Islands: University of British Columbia), 33–41.

Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. *Environ. Dev.* 18, 14–25. doi: 10.1016/j.envdev.2015.12.001

Reay, D. (ed.). (2019). "Climate-Smart Bananas," in *Climate-Smart Food*, (Berlin: Springer), 81–91. doi: 10.1007/978-3-030-18206-9_7

Rotmans, J., and Loorbach, D. (2009). Complexity and transition management. *J. Ind. Ecol.* 13, 184–196. doi: 10.1111/j.1530-9290.2009.00116.x

Selig, E. R., Hole, D. G., Allison, E. H., Arkema, K. K., Mckinnon, M. C., Chu, J., et al. (2019). Mapping global human dependence on marine ecosystems. *Conserv. Lett.* 12:e12617.

Singh, G. G. (2020). Determining a path to a destination: pairing strategic frameworks with the Sustainable Development Goals to promote research and policy. *Evol. Inst. Econ. Rev.* 17, 521–539. doi: 10.1007/s40844-020-00162-5

Singh, G. G., Cisneros-Montemayor, A. M., Swartz, W., Cheung, W., Guy, J. A., Kenny, T.-A., et al. (2018). A rapid assessment of co-benefits and trade-offs among Sustainable Development Goals. *Mar. Policy* 93, 223–231. doi: 10.1016/j.marpol.2017.05.030

Singh, G. G., Eddy, I. M., Halpern, B. S., Neslo, R., Satterfield, T., and Chan, K. M. (2020). Mapping cumulative impacts to coastal ecosystem services in British Columbia. *PLoS One* 15:e0220092. doi: 10.1371/journal.pone.0220092

Singh, G. G., Hilmi, N., Bernhardt, J. R., Cisneros Montemayor, A. M., Cashion, M., Ota, Y., et al. (2019). Climate impacts on the ocean are making the Sustainable Development Goals a moving target travelling away from us. *People Nat.* 1, 317–330. doi: 10.1002/pan3.26

Singh, G. G., Oduber, M., Cisneros-Montemayor, A. M., and Ridderstaat, J. (2021). Aiding ocean development planning with SDG relationships in Small Island Developing States. *Nat. Sustain.* 4, 573–582.

Singh, G. G., Sinner, J., Ellis, J., Kandlikar, M., Halpern, B. S., Satterfield, T., et al. (2017). Mechanisms and risk of cumulative impacts to coastal ecosystem services: an expert elicitation approach. *J. Environ. Manag.* 199, 229–241. doi: 10.1016/j.jenvman.2017.05.032

Ssebulime, G., Nyombi, K., Kagezi, G., Mpiira, S., Byabagambi, S., Tushemereirwe, W., et al. (2019). Assessing the potential of trees to sustain soil fertility in the banana agroforestry system in Uganda. *Agroecol. Sustain. Food Syst.* 43, 662–677. doi: 10.1080/21683565.2019.1566190

UN. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. New York: United Nations

Waldron, A., Garrity, D., Malhi, Y., Girardin, C., Miller, D. C., and Seddon, N. (2017). Agroforestry can enhance food security while meeting other sustainable development goals. *Trop. Conserv. Sci.* 10:1940082917720667.

Worldbank. (2021). *World Bank National Accounts Data, and OECD National Accounts data files*. Washington, DC: World bank.

WTTC. (2019). *Aruba 2019 Annual Research: Key Highlights*. London: World Travel & Tourism Council.

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