Chapter 14 SDG 14: Life below Water – Impacts on Mangroves

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Key Points

- SDG14 focuses on fisheries, though coastal forests such as mangroves are indirectly linked as they support fisheries and associated human coastal populations.
- SDG 14 benefits coastal forests, but negative impacts are also envisaged. These include (but are not limited to) encouraging new deforestation drivers, reducing environmental justice and encouraging governance recentralisation. SDG 14 may also encourage the creation of very large marine protected areas (often in the open ocean) that do not cover coastal forests or cannot be adequately enforced without concomitant increases in funding.
- Considering coastal forests more explicitly during the planning of SDG 14 targets may anticipate or ameliorate some of these negative impacts.
- With the exception of Target 14.1, the below-water focus of most SDG 14 targets means that terrestrial–marine linkages (e.g. sediment, nutrients, pollution, financial flows) are not strongly acknowledged; it is in this transition zone where coastal forests are found.
- Governance challenges increase the likelihood that SDG 14 will have negative impacts on coastal forests. Coastal forests often fall through policy gaps between terrestrial and marine legislation and between different governance levels. Governance decentralisation (itself threatened by some SDG 14 targets) and community management may negate some impacts.
- Other SDGs are likely to impact coastal forests and SDG 14. Conflicting objectives identified in particular include SDGs 1 (No Poverty), 2 (Zero Hunger), 11 (Sustainable Cities and Communities) and 15 (Life on Land).

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14.1 Introduction

The SDGs provide multiple opportunities for coastal and marine areas (Szabo et al. 2015) by addressing coastal poverty, prioritising conservation and explicitly recognising climate change. Coastal and marine environments are relevant to most SDGs, but are explicitly considered under SDG 14, Life below Water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development. SDG 14 aims to increase the protection and sustainable management of coastal and marine ecosystems and their resources while addressing threats such as pollution and ocean acidification. National policymakers have been criticised for not prioritising SDG 14 to the same degree as other SDGs (Custer et al. 2018). However, SDG 14 was a particular focus at the recent 2017 High Level Political Forum on Sustainable Development, where 17 out of 43 countries explicitly stated in their Voluntary National Reviews how they were working towards SDG 14 (UN DESA 2017).

While development and environmental concerns are not always in conflict, the inherent development focus of the SDGs means that these goals may themselves have negative environmental impacts (Kopnina 2016). The coastal and marine focus of SDG 14 means that it may have impacts on coastal forested ecosystems, such as intertidal mangrove forests, beach dune forests and tidal freshwater forested wetlands. With population densities significantly higher in the coastal zone than interior areas (Neumann et al. 2015), the negative impacts of SDG 14 on coastal forests discussed here are also expected to impact the hundreds of millions of people who directly or indirectly derive benefits from coastal forest ecosystems.

This chapter outlines the potential positive contributions of mangroves to SDG 14 and the negative impacts of SDG 14 implementation on (1) mangrove forests and (2) the local communities that derive direct and indirect livelihood benefits from them. We differentiate between these because SDG 14 may affect human systems differently from natural systems. Teasing out such interactions and complexities is key to understanding the myriad impacts that SDG 14 may have on coastal forests.

14.2 Mangrove Forests as a Lens to Analyse SDG 14

14.2.1 Why Focus on Mangrove Forests?

Multiple ecosystems come under the definition of coastal forests, including beach forests and tidally influenced freshwater forested wetlands. In this study, mangrove forests have been chosen as a proxy for coastal forests for the following reasons:

1. Mangroves cover 83 500–137 000 km^2 (Giri et al. 2011, Hamilton and Casey 2016) across the tropics, subtropics and warm temperate zones. Mangroves are potentially relevant to the SDG aspirations of at least 118 countries and territories (Giri et al. 2011), spanning a gradient of economic development across the Global North and Global South.

2. Potentially hundreds of millions of people rely directly on mangroves and their ecosystem services.

3. Mangroves are strongly linked to fisheries (Carrasquilla-Henao and Juanes 2017), a key component of SDG 14, due to the role of the forest as a spawning and nursery ground for commercially important fish species.

4. As mangroves are located between terrestrial and marine zones, they provide strong synergies between SDG 14 and other SDGs. For example, mangrove conservation (Target 14.2) provides coastal protection benefits, strengthening coastal community resilience to climate-related hazards (Target 13.1).

5. Increased international policy attention around mangroves and high levels of scientific knowledge compared with other coastal forest types provides more case studies and literature to discuss potential SDG 14 impacts.

Our focus on mangroves precludes a global analysis, though we are still able to make comparisons between the Global North and the Global South since mangrove-holding countries span a gradient of economic development. Several countries in the Global North have subtropical mangrove resources, including the USA, Australia, New Zealand and the overseas territories of several European countries.

A focus on mangroves excludes terrestrial forests located along the coast that are *not* coastal forests. While we make links to these forest types in relevant instances, we generally do not consider them here because terrestrial forests are supratidal, so may only be intermittently flooded compared to mangroves. Thus, they are not as strongly linked to coastal fisheries as mangroves, and thus may not be immediately covered by SDG 14. Instead, they are more likely to be managed under SDG15 (Life on Land). Splitting SDGs 14 and 15 into water and land misses key linkages between these spheres.

14.2.2 The Relevance of Mangrove Forests to SDG 14

SDG 14 strongly focuses on fisheries, which is one ecosystem service provided by mangroves, with many coastal communities across the tropics directly using mangrove forests as fishing grounds and nursery areas (Carrasquilla-Henao and Juanes 2017). Complex root systems shelter juvenile fish from

predators, and mangroves provide food and nutrients for fishes. Mangroves provide additional ecosystem services to coastal communities, including storm protection, pollutant trapping and a variety of cultural ecosystem services, which can all contribute in some form to most of the SDG 14 targets (Table 14.1). Most recently, mangroves have been placed high on the policy agenda of many international bodies due to their role in carbon sequestration and storage. Mangroves are an example of a blue carbon ecosystem, with an ability to store carbon at densities three to five times that of other tropical forests (Donato et al. 2011). This makes mangroves a useful tool to help offset the fossil-fuel emissions of a number of countries under the Paris Agreement (Taillardat et al. 2018).

Table 14.1 Contribution of mangrove ecosystem services to SDG 14

Ecosystem service	Contribution	SDG target(s)
Provisioning services Fish production	Positive linkages exist between fish production and mangrove extent (Whitfield 2017)	Various
Fuel (wood, charcoal)	High-calorific mangrove wood can be used through mangrove harvesting (Sillanpää et al. 2017), a potentially sustainable resource.	14.2, 14.7
Non-timber forest products (e.g. honey, waxes, tannins, non-fish foods)	Numerous provisioning ecosystem services can be extracted under sustainable management (Uddin et al. 2013)	14.2, 14.7
Regulating services Carbon storage and sequestration	Carbon storage provides financial incentives to protect and sustainably manage mangroves (Alongi 2011)	14.2, 14.5, 14.7
Coastal protection	Roots and topography reduce wave energy through friction; coastal protection is a strong driver of mangrove restoration (Spalding et al. 2014)	14.2
Waste processing	Mangroves can assimilate pollutants in their soils and biomass (Ouyang and Guo 2016)	14.1

Table 14.1 (cont.)

Ecosystem service	Contribution	SDG target(s)
Ocean acidification regulation	Mangroves can increase water alkalinity (Sippo et al. 2016); however, mangroves only influence pH at local scales	14.3
Cultural services Tourism	Mangrove tourism provides livelihoods and a financial incentive for conservation (Foucat 2002)	14.1, 14.5
Recreation	Recreation provides well-being, livelihoods and a financial incentive for conservation (Ahmad 2009)	14.1, 14.5
Education	Traditional ecological knowledge about mangroves and their resources can complement scientific knowledge	14.A

14.2.3 A Framework to Understand the Impact of SDG 14 on Mangrove Forests

While mangroves may contribute to achieving SDG 14, this goal does not explicitly focus on mangrove forests. Ecosystems not explicitly considered by an SDG may be more likely to be negatively impacted. In an analysis of the 2017 VNRs to the UN, only 11 of 118 countries and territories with mangroves mentioned SDG 14 in their executive summaries. Of these, 10 focused predominantly on the role of fisheries, reflecting the dominant focus of SDG 14. Only 5 mentioned mangroves, most doing so in a single sentence. For example, Bangladesh's review states that mangrove afforestation could protect the coastal zone and islands (Government of the People's Republic of Bangladesh 2017). In the VNRs, mangroves are likely to be implicit within SDG targets that vaguely describe marine and coastal ecosystems (Target 14.2) or coastal and marine areas (Target 14.5).

Some SDG targets and their indicators may indeed be positive for mangroves and others may not. Impacts may also be positive or negative depending on whether the impact accrues on the ecosystem or the local communities that rely on them (Table 14.2). In Section 14.3 we consider each SDG 14 target and its indicator, and the potential negative impacts each may have on (1) the mangrove ecosystem; and (2) local communities reliant on mangrove resources.

Table 14.2 The possible effects of the SDG 14 targets on the mangrove ecosystem and associated local human communities [yellow = potential positive benefit; orange = potential for both mixed impacts]

Target	Indicator	Relevance to mangrove ecosystem	Relevance to local communities
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	Index of coastal eutrophication and floating plastic debris density	POSITIVE – Reduction in pollution is positive for forest health and macrobenthic biodiversity	MIXED – Positive: local communities benefit from reduced pollution over the long term – Negative: pollution controls could have negative short-term economic impacts for local industries, with knock-on impacts on local employment
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Proportion of national exclusive economic zones managed using ecosystem-based approaches	MIXED – Positive: sustainable management and restoration increases mangrove area, health and ecosystem services – Negative: it could promote large-scale monoculture planting in unsuitable areas, leading to failed restoration	MIXED – Positive: increased ecosystem services for communities to use – Negative: international donor-supported restoration can lead to community dependency – Negative: sustainable management activities – e.g. forestry or Payments for Ecosystem Services can lead to land grabs and conflicts within communities

14.3 Minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	Average marine acidity (pH) measured at agreed suite of representative sampling stations	POSITIVE – Positive impacts for calcified organisms such as shellfish	POSITIVE – Positive impacts for livelihoods linked to shellfish fisheries
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Proportion of fish stocks within biologically sustainable levels	MIXED – Positive: for fisheries related to mangroves – Negative: could lead to increased aquaculture in mangrove areas to compensate for reduced wild-caught fishing	MIXED – Positive: fisheries may become more sustainable over the long term – Negative: stronger regulation of overfishing and unregulated fishing may have negative short-term economic impacts – especially if enforcement efforts focus on local communities rather than on large industrial players (which have a bigger ecological impact but may be more politically sensitive to regulate)

Table 14.2 (cont.)

Target	Indicator	Relevance to mangrove ecosystem	Relevance to local communities
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	Coverage of protected areas in relation to marine areas	MIXED – Positive: a greater percentage of mangroves will be protected – Negative: 'leakage' pushes deforestation pressures to neighbouring unprotected mangroves – Negative: potential for 'paper parks' that look good on paper but are not enforced or resourced – Negative: mangroves may be excluded from this target because it is easier to achieve such large targets in open-ocean areas	MIXED – Positive: more protected mangroves mean more ecosystem services for communities – Negative: communities can be excluded or removed from certain types of marine protected areas – Negative: governments and industry can use protected areas as a land-grabbing tool – Negative: potential equity issues (gender, ethnicity, class)

14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognising that appropriate and effective special and differential treatment for developing and least-developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing	MIXED – Positive: could remove perverse onshore aquaculture subsidies and incentives that encourage mangrove deforestation – Negative: could encourage shift to other agriculture types, if aquaculture no longer financially attractive	MIXED – Positive: if linked to perverse aquaculture subsidies and incentives that encourage mangrove deforestation; communities may retain land or access to mangroves – Negative: may cause reduced employment opportunities – Negative: can change or remove local economic structures

Table 14.2 (cont.)

Target	Indicator	Relevance to mangrove ecosystem	Relevance to local communities
14.7 By 2030, increase the economic benefits to small island developing States and least-developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	Sustainable fisheries as a percentage of GDP in small island developing States, least-developed countries and all countries	MIXED – Positive: should reduce environmental impacts if forest resources used/ harvested sustainably – Negative: increased economic benefits could lead to unregulated development and cause environmental harm e.g., tourism and aquaculture can cause disturbance and mangrove loss – Negative: increased livelihoods due to sustainable management can increase demand for forest products, causing further environmental harm	MIXED – Positive: sustainable management protects ecosystem services that communities use – Positive: increased local livelihoods – Negative: economic uses can exclude certain parts of the community, e.g. communities restricted access to REDD+ sites or can no longer extract certain resources

14.A Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least-developed countries	Proportion of total research budget allocated to research in the field of marine technology	MIXED – Positive: if improvement of aquaculture techniques increase efficiency and reduce demand for converting mangrove forests – Positive: if technology for restoration is enhanced – Negative: technological innovation could lead to increased pressure to clear mangroves for aquaculture	MIXED – Positive: improvement of aquaculture techniques increases profitability – Negative: technical innovation could reduce labour requirements
14.B Provide access for small-scale artisanal fishers to marine resources and markets	Progress by countries in the degree of application of a legal/regulatory/policy/institutional framework which recognises and protects access rights for small-scale fisheries	MIXED – Positive: if it encourages more sustainable practices – Negative: increased access could have negative environmental impacts if not regulated adequately	POSITIVE – Increases livelihoods – Increases access to resources and environmental justice, especially if institutional frameworks can promote gender issues alongside access rights

Table 14.2 (cont.)

Target	Indicator	Relevance to mangrove ecosystem	Relevance to local communities
14.C Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS [UN Convention on the Law of the Sea], which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want	Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the UNCLOS, for the conservation and sustainable use of the oceans and their resources	POSITIVE – Positive impacts on migratory species that use mangroves for some part of their lifecycle (birds, turtles) – Positive for reducing impacts of oil or other chemical spills, if UNCLOS extends to mangroves – Positive indirect impact if offshore fisheries management is improved, reducing pressure on near-shore resources.	POSITIVE – Less-polluted mangroves will better provide ecosystem services such as fisheries

14.3 SDG 14 Targets, Actors and Potential Impacts

14.3.1 Prevent and Significantly Reduce Marine Pollution – Target 14.1

Pollution, marine litter and eutrophication are significant issues in tropical coastal areas (Todd et al. 2010). Marine debris stems from improper solid-waste management practices, poor behavioural choices made by consumers and fishers (e.g. plastic pollution from fluvial sources, dumping of fishing gear or ship-generated waste) and poor waste disposal facilities or lack of access to them. Nutrient sources contributing to eutrophication include aquaculture outflows, factory discharges into rivers and coastal areas, and agricultural and urban runoff, all of which are expected to be exacerbated by global change (Rabalais et al. 2009). These issues are caused by numerous diffuse sources, making their management and reduction particularly difficult.

To address the issue of marine litter, the UN Environment Programme (UNEP) launched the Global Partnership on Marine Litter in June 2012. Known as the Honolulu Strategy, by 2025 it aims to reduce the impacts of litter, enhance cooperation and coordination through multi-stakeholder platforms, promote knowledge sharing and monitoring, promote economic development through resource efficiency and waste prevention, increase awareness, and assess emerging health and ecological issues of plastic waste (UNEP 2012). The G20 group of governments has also created an *Action Plan on Marine Litter* (G20 2017). Most EU countries have national policies to reduce marine litter (IUCN 2017), and similar national and regional strategies exist for nutrient and sediment pollution (Chen 2015).

ANTICIPATED IMPACTS ON MANGROVES

Protecting mangroves from pollution is important; a healthy mangrove can help buffer other coastal ecosystems from pollution and eutrophication because of its ability to trap heavy metals and excess nutrients (Valiela and Cole 2002). Reducing nutrient pollution also increases mangrove tolerance to extreme weather events (Feller et al. 2015). Mangroves are exposed to terrestrial and marine pollution sources because they exist at the transitional margin between land and sea. Thus, initiatives such as the Honolulu Strategy have great potential to protect mangroves through Target 14.1. Negative impacts can only be foreseen if Target 14.1 drives a focus on eutrophication and litter to the exclusion of other pollution types, such as noise or light pollution (which may affect mangrove fauna).

ACTORS INVOLVED OR AFFECTED

Addressing pollution may have unintended negative consequences if implementation does not adequately consider equity issues, e.g. who pays for or

bears the burden of pollution and its control and who makes decisions about pollution prevention. Are local communities involved and, if so, in what capacity? Marginalised populations and lower-income countries can bear a disproportionate cost of the negative impacts of pollution, while wealthy polluters can pay off their pollution debt (Torras and Boyce 1998). However, overregulation may also have short-term negative economic impacts for industries, with indirect impacts for the local people they employ. Thus, aspects of the Honolulu Strategy that emphasise the economic benefits of resource efficiency and waste prevention are particularly welcome.

Risk transfer is another key issue. In the absence of adequate land-based waste disposal, marine litter that is collected may eventually return to the coast. When planning ecosystem-based adaptation approaches to reduce pollution, we must consider the adequacy of pollution remediation mechanisms at source and whether we are shifting the problem to other ecosystems.

14.3.2 Sustainably Manage and Protect Coastal Ecosystems, Including Their Restoration – Target 14.2

Sustainably managing natural resources is a formidable challenge in any ecosystem due to weak governance, limited resources, corruption and conflicting pressures for short-term economic growth. Mangrove management shares these and comes with additional complications. Mangroves suffer from cross-sectoral conflicts and lack of communication, as they frequently fall under both marine and terrestrial jurisdictions, or neither (Friess et al. 2016a, Primavera 2000). Mangroves are also not included in many international forestry conservation and management initiatives – e.g. the initial lack of protocols and standards for including mangroves in international Payments for Ecosystem Services (PES) schemes such as REDD+.

Target 14.2 could be achieved by strengthening legislation that promotes sustainable management. Many mangrove-holding countries have national laws that aim to protect them either under specific mangrove laws or generic environmental protection policies (Slobodian et al. 2018). Hence, the challenge is not to advocate for new legislation but to enforce existing laws and build strong governance. Improved governance requires greater cooperation between sectors and actors. Ecosystem-based approaches that recognise the importance of ecosystem services and can adapt when faced with change are also important. Engaging with and empowering local communities in forest governance, often building on existing customary institutions, has been proven to ensure equity and effectively provide resources that are not available to national institutions (Friess et al. 2016a). Market-based solutions may also be effective if regulated effectively. These may involve traditional

sustainable-production forestry, such as the Matang Mangrove Forest Reserve in Malaysia, which provides wood for charcoal to local and regional markets (Goessens et al. 2014), or the BUMWI forestry concession in West Papua, Indonesia, the world's only Forest Stewardship Council (FSC)-certified mangrove plantation, providing wood chips to international buyers (Sillanpää et al. 2017). Alternatively, other ecosystem services, such as carbon, may be marketed through PES (e.g. Mikoko Pamoja in Kenya). However, market-based solutions come with their own potential issues, such as governance recentralisation (Phelps et al. 2010), inadequate benefit sharing (Phelps et al. 2013) and other challenges to environmental justice (Locatelli et al. 2014).

Target 14.2 could also be achieved through mangrove rehabilitation, which is increasingly being proposed over large scales. The 2011 Bonn Challenge aims to restore 150 million ha of degraded and deforested land by 2020 and 350 million ha by 2030. Of the countries that have pledged, 27 have mangroves within their national borders. The Bonn Challenge is promoted as a vehicle to achieve existing international commitments, including the CBD[1] Aichi Target 15 (relating to ecosystem resilience and restoration), UNFCCC[2] REDD+ goals and the Rio+20 land degradation neutrality goal. A mangrove-specific initiative is the Global Mangrove Alliance (GMA) – a partnership between major conservation NGOs – that aims to stop deforestation and increase current mangrove area by 20 per cent by 2030 (GMA 2017).

ANTICIPATED IMPACTS ON MANGROVES

Given current threats, establishing ambitious, well-funded and centrally coordinated targets for mangrove restoration seems an obvious and necessary goal. However, large-scale mangrove restorations often fail. For example, 97 per cent of replanting efforts surveyed in Sri Lanka showed partial or complete mortality of trees (Kodikara et al. 2017), and thousands of hectares of mangrove plantations in the Philippines have been established on inappropriate areas, which reduces mangrove survival and damages and replaces valuable habitats such as seagrasses (Primavera and Esteban 2008). These failures occur even though several practitioner manuals and best-practice documents exist (Lewis and Brown 2014, ZSL 2015). There is a disconnect between the recommendations of these manuals and the target setting, coupled with low monitoring requirements of international donors.

Even when healthy trees are established, planting can result in ecologically impoverished monocultures that are less resistant to ecological stress and disturbance (Villamayor et al. 2016). For these reasons, approaches based

[1] Convention on Biological Diversity.
[2] UN Framework Convention on Climate Change.

on hydrological restoration, such as Ecological Mangrove Restoration (EMR) (Lewis 2005), should be used whenever possible. These approaches take time, expertise and extensive on-site pre-planning, but rushing to reach inflated artificial planting targets is likely to result in failures and increased cynicism about rehabilitation potential.

ACTORS INVOLVED OR AFFECTED

Mangroves are complex socio-ecological systems, with numerous actors at different hierarchical levels involved in their restoration and sustainable management. Large-scale restorations are often promoted by international donors and NGOs, as is seen with the Bonn Challenge and the GMA. National and local government agencies are often involved in granting permission for or implementing restoration, though jurisdictions among agencies may be blurred (Primavera 2000).

Large-scale restoration projects are conducted in degraded areas where human influence is high, affecting neighbouring communities. Environmental justice often demands the involvement of local communities in restoration. Practical arguments for involving local people are also strong since resources for external management may be limited. However, paying communities to undertake restoration, as is the norm, can set up a cycle of dependency. This includes economic dependency, with communities potentially encouraging rehabilitation failure so that they can get paid to replant multiple times; planting payments can become a substantial part of the local economy, providing little incentive for restoration to be successful (Thompson 2018). However, dependency can be broken by using other metrics of success (e.g. focusing on per cent of survival, as opposed to per cent planted), paying communities for tasks other than planting (e.g. digging creeks for hydrological restoration), or co-funding restoration projects in conjunction with local communities (Thompson 2018). Some of these approaches have been applied with great success, such as hydrological restoration through community-based EMR in Indonesia, Thailand and Latin America (Brown et al. 2014).

Other methods of achieving Target 14.2 may also impact local communities. Monetised incentives for mangrove management, such as the demarcation of forestry concessions or PES schemes, may challenge environmental justice by risking elite capture and land grabs by powerful stakeholders (Beymer-Farris and Bassett 2012) or exacerbate existing gender inequalities (e.g. where male heads of households receive payments). Explicit commitments and safeguards to environmental justice and gender equality as part of project design and execution are essential to mitigate these risks.

Mangroves are complex socio-ecological systems. Large-scale global restoration and sustainable management ambitions required under Target 14.2 must account for this complexity by involving local as well as national and

international stakeholders. Nested governance, responsive to local needs and guided by environmental justice and ecosystem management, may seem complex when set against the stirring simplicity of the SDG visions. Realising the promises of those visions for mangroves will mean the careful use of what we already know about successful mangrove management, restoration and governance.

14.3.3 Regulate Harvesting and End Overfishing – Target 14.4

Fishing is critical to the food security and livelihoods of hundreds of millions of people. Unfortunately, 89.5 per cent of fisheries are either fully exploited or overfished (FAO 2016), up from 70 per cent a decade earlier (FAO 2006). Target 14.4 aims to reduce overfishing through improved fisheries management, reduction of harmful fishing practices, stronger monitoring and enforcement, reduced by-catch and eco-labelling (Vierros and Buonomo 2017). The Sundarbans – one of the largest mangrove forests in the world – provides a good example of how Target 14.4 could be implemented. This area faced over-exploitation of fisheries by local communities in the 1990s, resulting in declining yields. The Bangladesh government, supported by the Asian Development Bank, strengthened legislation to deal with this issue, including the banning of fishing for certain species, minimum size limits for harvesting and the introduction of minimum net sizes (Hoq et al. 2007).

ANTICIPATED IMPACTS ON MANGROVES

Target 14.4 may be focused primarily on offshore fisheries, as this is where a large amount of fishing effort is based. However, if there is a stronger focus on inshore fisheries, then this target is anticipated to positively impact faunal components of the mangrove ecosystem by reducing harvesting pressure on fish and shellfish stocks. For example, traditional regulation of fisheries in Okinawa's mangroves and other inshore areas has successfully sustained fish stocks over centuries (Akimichi and Ruddle 1984). Similarly, the sasi system – a local traditional coastal resource management system in eastern Indonesia – is associated with increased effectiveness of environmental protection (McLeod et al. 2009). Linking existing traditional and government regulations with further business-sector demand may be an alternative way to ensure the sustainability of wider fisheries value chains and the mangroves that support them. However, the success of measures such as these relies on sufficient enforcement, whether by government or the community, and the provision of alternative livelihoods and food sources if access to fisheries is limited. Of particular concern is whether stronger enforcement in capture fisheries pushes food and economic security more towards aquaculture, the

dominant driver of mangrove deforestation across the tropics (Hamilton 2013, Richards and Friess 2016).

ACTORS INVOLVED OR AFFECTED

State actors are often heavily involved in the implementation and enforcement of Target 14.4 and frequently face challenges and limitations in resources for operational costs and enforcement. The actors contributing most to heavy fishing pressure are likely to be commercial operators, especially in open-sea fisheries. It is less clear whether this is the case in mangrove-related fisheries, where local communities contribute to localised overfishing. Regulations and enforcement of overuse are thus expected to impact local communities and their economic pathways (Silva-Cavalcanti and Costa 2009). Impacts include increased transaction costs of fishing (if particular fishing equipment is banned or changed) and decreased food security (if certain fish species or fishing areas are banned). In these cases, alternative food and livelihood sources need to be considered. The implementation of Target 14.4 requires rules designed to control large-scale commercial fishery operations that do not place unintended restrictions on local fish harvesting and consumption.

14.3.4 Conserve at Least 10 Per Cent of Coastal and Marine Areas – Target 14.5

Protected areas are a traditional method of habitat conservation, and marine protected areas (MPAs) have increased in the tropics, driven by national and international policy concerns. Target 14.5 further promotes protected areas as a conservation tool by pushing for an increase in the proportion of coastal and marine areas to be protected to 10 per cent by the year 2020, aligning closely with Aichi Target 11 (Rees et al. 2017). MPAs cover about 3.25 million km^2 globally (Roberts et al. 2018) and some countries have already achieved SDG Target 14.5, such as Belize protecting 21 per cent of its national waters (Government of Belize 2017). Yet the targets set by some countries are currently not strong enough. For example, only 6.3 per cent of Bangladesh's coastal and marine protected area is scheduled to be protected by 2020 (Government of the People's Republic of Bangladesh 2017), though the already protected Sundarbans mangroves do make up a proportion of this.

MPAs are often focused on reefs (Edgar et al. 2014) or open-water ecosystems, such as those important for pelagic fisheries. Mangroves have not traditionally been the main focus of MPAs (Friess et al. 2016a), therefore we would expect the proportion of mangroves under protection to lag behind what is required of SDG Target 14.5. If SDG Target 14.5 is to protect 10 per cent of coastal and marine areas, and particularly mangroves, this will require the substantial strengthening of national and international protected-area

legislation, including the establishment of new mangrove MPAs and proper enforcement for existing areas. The proportion of mangroves covered in protected areas should be reported by member states in their annual National Biodiversity Strategic Action Plans to the Convention on Biological Diversity to monitor progress.

ANTICIPATED IMPACTS ON MANGROVES

While the establishment of new MPAs would be expected to result in positive environmental outcomes, several negative impacts are envisaged. Firstly, ambitious targets to increase protected area extent are achieved through the establishment of very large marine protected areas (VLMPAs) that cover hundreds of thousands of square kilometres (Jones and De Santo 2016). Because of their size, VLMPAs are primarily established in the open ocean. It is harder to achieve large-scale protection in the coastal zone due to the many conflicting stakeholders and the need for resource access. Target 14.5 may promote the creation of VLMPAs in the open ocean at the expense of smaller coastal MPAs that would incorporate coastal forests and benefit the local communities that rely on them.

Secondly, MPAs will only have positive environmental outcomes if sufficiently resourced and enforced so that infringements such as local mangrove deforestation can be stopped. Setting up MPAs without adequate resourcing often leads to the establishment of 'paper parks' that technically meet Target 14.5 requirements but show low success on the ground. For example, the establishment of protected areas in Indonesia has not necessarily reduced mangrove deforestation (Miteva et al. 2015), where oil palm has been found encroaching into protected areas in Langkat Regency, north Sumatra, and other protected areas have suffered from aquaculture encroachment. We should move beyond simple area targets and focus instead on protected area quality, not quantity (Barnes et al. 2018).

Finally, protected areas can drive leakage, where deforestation and degradation are stopped within the protected area but shifted off-site into neighbouring unprotected mangroves or other unprotected ecosystems. Leakage is a common issue in forested ecosystems; it is hard to monitor and remains a major challenge in mangroves (Locatelli et al. 2014). Leakage can be reduced by increasing monitoring around the protected area, increasing the scale of the protected area to cover locations particularly at risk or creating protected area networks. However, it is debatable whether these solutions solve leakage or push it even further off-site.

ACTORS INVOLVED OR AFFECTED

MPAs are most successful when they have clear objectives and strong enforcement (Edgar et al. 2014). These are most often in the control of the state actors

who have the capacity to manage and monitor large areas, e.g. government national park agencies. Centralised resource management goes against decades of governance decentralisation in the tropics, with the potential for local community exclusion (Phelps et al. 2010) and the reassertion of state control over community lands that can lead to land grabs (Beymer-Farris and Bassett 2012). This has been highlighted as a potential consequence of Aichi Target 11 (and, by extension, SDG Target 14.5), which explicitly requires equitable management of MPAs (Rees et al. 2017).

Environmental justice has important implications for MPA success because MPA performance is not determined solely by top-down processes. When national governments implement Target 14.5, they should consider how to incorporate communities and local practices into MPA design. The International Union for Conservation of Nature (IUCN) promotes seven categories of protected areas, some of which allow community use or interaction (IUCN 2012). MPAs that have strong community support can be more successful in achieving conservation objectives compared to those without (Francis et al. 2002). Similarly, community-managed mangrove forests can have better conservation outcomes than state-managed forests (Sudtongkong and Webb 2008). The equity and economic security of local communities must always be considered, particularly because mangrove protected areas can be associated with short-term livelihood losses, while the economic benefits may accrue over the long term (McNally et al. 2011).

14.3.5 End Certain Forms of Fisheries Subsidies – Target 14.6

Industrial fisheries politically and administratively overwhelm concerns about mangrove conservation, as nations exploit fisheries for income and food security. Their importance means that fisheries are subsidised in most nations, with global fishing subsidies valued at USD 25–29 billion annually (Sumaila et al. 2010). In Global North countries containing mangroves (e.g. Japan, Taiwan, USA) subsidies overwhelmingly support catch fisheries (European Commission 2017). In many Global South nations subsidies also support onshore aquaculture activities through fuel subsidies, tax exemptions and aquaculture extension. For example, the Government of India subsidises pond construction, input costs, hatcheries and monitoring costs (DAHD 2016). Target 14.6 is currently ambiguous as to whether such farmed fishing practices fall under its remit.

Industrial aquaculture, supported by subsidies, has been the predominant cause of mangrove loss in recent decades, representing one of the major threats to mangrove-dominated coastal and delta areas (e.g. Richards and Friess 2016). The importance of the aquaculture sector for economic

development means that fishery subsidies have been made in both direct and indirect ways: such subsidies have contributed to many of the environmental problems seen with the aquaculture industry (Neiland et al. 2001), such as deforestation (Barbier and Cox 2004). Achieving Target 14.6 requires changes to national legislation that currently provides aquaculture subsidies and incentives in many tropical countries.

ANTICIPATED IMPACTS ON MANGROVES

Removing aquaculture subsidies should have immediate positive benefits for mangrove ecosystems by making it more expensive and less appealing to expand aquaculture operations into mangrove areas. The concerns are that it may shift people's attention to other economic activities that impact mangroves, especially if they are also the focus of government subsidies. In Southeast Asia we are already seeing the replacement of mangroves and abandoned aquaculture by oil palm, particularly in Indonesia and Malaysia (Richards and Friess 2016). This may become an even greater threat in the future, as oil palm is now the focus of substantial national financial subsidies in order to achieve ambitious production targets to secure food and economic security in these countries. Thus, in the medium to long term, mangrove deforestation will persist in many countries even as aquaculture subsidies are phased out.

ACTORS INVOLVED OR AFFECTED

Target 14.6 signals to actors that we need to change our expectations that we can increase fishery production through mangrove clearance in unsustainable ways. As this involves changes to national legislation and economic priorities, state actors are key to Target 14.6 implementation. Significant political will at the country level is required to end fishery subsidies and the allocation of mangrove areas to aquaculture.

Commercial actors and community actors will be affected by Target 14.6. At the local scale, conflicts between two parts of society and Target 14.6 will occur. Investing in aquaculture is often expensive, so only affluent stakeholders are able to invest in such a business or secure appropriate loans (Barbier and Cox 2004, Primavera 1997). These investments will be impacted by changes in aquaculture subsidies. Local communities who are employed by commercial stakeholders may face unemployment or reduced employment if fisheries subsidies are removed. The need for further economic gains and employment opportunities is likely to drive actors into other, potentially unsustainable industries, as noted above. Target 14.6 needs to take a broader view than solely aquaculture subsidies, to include alternative subsidised income streams and the impacts they may have on the mangrove ecosystem.

14.3.6 Increase Economic Benefits from the Sustainable Use of Marine Resources – Target 14.7

Target 14.7 focuses on improving the economies of developing nations and small island states by increasing the sustainable use of marine resources, primarily through sustainable fisheries. This could be achieved in many ways, promoted by technological, commercial and governance influences. Target 14.7 suggests that aquaculture and tourism can play a role in achieving Target 14.7, though these do not match with the SDG indicator for this target. It may be unclear how current forms of intensive aquaculture in mangrove areas could match the sustainable-use focus of Target 14.7. Mangrove ecotourism fits under the broad description of Target 14.7 and is a popular management activity in many mangrove areas across the tropics, particularly in Central America and some Southeast Asian countries (such as the Philippines and Malaysia). To increase economic benefits in the coastal zone, it is good that Target 14.7 looks beyond fisheries. However, we see that there are more opportunities because mangroves could be a key contributor to Target 14.7 if the sustainable use of other marine resources could be incorporated. This can be done most obviously with provisioning ecosystem services provided by mangroves (timber, fuelwood, non-timber forest products, food resources, pharmaceuticals) and some regulating services (carbon, nutrients). When broadened beyond fisheries, Target 14.7 has strong synergies with Target 14.2.

Standards and certifications can promote sustainable management practices and they do exist in fishing activities (e.g. Marine Stewardship Council) and mangrove aquaculture (e.g. in Vietnam). This can be expanded to other mangrove ecosystem services. For example, FSC certification requires strict adherence to environmental and social standards for logging operations, with certified products generally attracting a premium on the market, particularly in the Global North (Hoang et al. 2015). There is huge scope to expand this: currently, only one FSC-certified mangrove concession exists worldwide, in West Papua, Indonesia (Sillanpää et al. 2017). PES (see Target 14.2) is another method of promoting a switch from exploitative to sustainable management: it requires stakeholders to change land-use practices to protect and/or increase the ecosystem service of interest.

ANTICIPATED IMPACTS ON MANGROVES

Target 14.7 is expected to positively impact fisheries, since they are the main focus. We also expect positive impacts on other mangrove ecosystem services, if the target expands to them. However, as the following examples demonstrate, 'sustainable' management can have adverse and unintended consequences on ecosystem quality.

Ecotourism is an increasingly common method of mangrove management in many countries. While ecotourism can increase local livelihoods and educate visitors, it is frequently associated with negative environmental impacts. For example, mangrove ecotourism in Langkawi, Malaysia, has been associated with pollution and erosion, as speedboats disobey speed limits during tours (Lee 2013).

Matang Mangrove Forest Reserve is an approximately 30 000 ha charcoal production area in Malaysia that has been managed through rotational harvesting for some 100 years. As such, it is often held up as a leading example of long-term sustainable logging (Shaharuddin et al. 2005). However, these practices have progressively turned this area from a biodiverse mangrove into a monoculture, as *Rhizophora* spp. are strongly preferred for charcoal. Its long-term sustainability has also been brought into question due to lower propagule production and natural regeneration (Goessens et al. 2014) and potential declines in plant productivity.

Sustainable management may increase local livelihoods but can have perverse impacts on environmental resources. For example, sustainable sea cucumber fisheries have been promoted by an NGO in Madagascar to create more secure livelihoods for local communities. These communities previously conducted small-scale selective logging for poles and house-frame construction. However, increased disposable income in these communities means that many households have upgraded their homes to lime render, which increases durability and is a status symbol. Lime render requires the collection of a large volume of gastropod shells, which are burned down in kilns fuelled by mangrove wood (Figure 14.1). This has forced a transition from selective logging to larger-scale mangrove clearance when lime orders come in (Scales et al. 2018).

ACTORS INVOLVED OR AFFECTED

Target 14.7 should have positive economic impacts for commercial parties and local communities who adhere to sustainable management, if a product has a suitable premium and an existing market. Local communities stand to benefit especially if sustainable management certifications have built in strong social safeguards, such as FSC certification.

Social safeguards are important because sustainable management practices can have negative consequences for local communities if production rates are lowered. This is particularly so if sustainable resource use requires high levels of initial investment, which can lead to bigger companies pushing out smaller local companies. For example, the promotion of mangrove ecotourism by a government development agency in Langkawi, Malaysia, has encouraged larger national companies to come into the area to invest in the operation, with negative consequences for small local operators who

Figure 14.1 Clearcutting of mangroves in the Bay of Assassins, Southwest Madagascar, in response to market demands for lime kilns. Photo by Dan Friess.

had been conducting ecotourism activities but lack the financial resources or political connections to compete (Thompson et al. 2018). Negative social consequences are often seen in PES schemes (Pascual et al. 2014, Pouyal et al. 2016), where sustainable management and conservation of the ecosystem service (e.g. carbon) excludes local communities from lands in order to minimise impact. In Tanzania efforts to prepare for a REDD+ project led to land grabs and state protectionism at the expense of community environmental justice (Beymer-Farris and Bassett 2012).

14.3.7 Increase Scientific Knowledge, Capacity and Marine Technology – Target 14A

Target 14.A could be achieved by the transfer of capacity and marine technology related to onshore aquaculture – for example, by sharing knowledge and technology that improves aquaculture yields or diversifies aquaculture products such as algae without increasing the current aquaculture footprint. Knowledge sharing may be difficult in some cases as aquaculture is a commercial endeavour, so there is little incentive to share information with competitors. Aquaculture extensionists and new networks of communication (such as efforts to communicate market prices or mobile technology to alert shrimp disease) play an important role in achieving this target.

Capacity and knowledge could also be shared on the topic of mangrove restoration. As noted under Target 14.2, mangrove restoration is notoriously unsuccessful (Kodikara et al. 2017, Lewis 2005, Primavera and Esteban 2008), most often because inappropriate species are planted in inappropriate locations. Several practitioner manuals exist in multiple languages (Lewis and Brown 2014) to facilitate knowledge transfer from successful projects, so it is not an issue of creating more materials and manuals. Rather, it is an issue of communication, translation and knowledge sharing. Target 14.A could bolster this through international platforms such as the IUCN Mangrove Specialist Group and the GMA.

ANTICIPATED IMPACTS ON MANGROVES

Target 14.A may positively benefit mangroves if improvement of aquaculture techniques increases yields within existing ponds and reduces pollution, thereby reducing demand for converting neighbouring mangrove forests and other adjacent ecosystems. However, this has just as much chance of negatively impacting mangroves, as technological innovation leads to increased profitability, increasing pressure to clear more mangroves as aquaculture expands to take advantage of commercial opportunities. There is huge debate in the conservation field about whether increased productivity results in land sparing or agricultural expansion, with several studies suggesting the latter to be true, to the extent that conservation costs actually increase (Carrasco et al. 2014, Phelps et al. 2013).

ACTORS INVOLVED OR AFFECTED

Several actors are involved in marine technology and its transfer, including the commercial actors creating such technology and the national and international platforms facilitating knowledge transfer (e.g. the GMA could play a key role in communicating proper standards for mangrove restoration).

Local communities and businesses will be impacted by any increases in knowledge and technology, creating a positive impact on livelihoods if the improvement of aquaculture techniques increases profitability and if it trickles down to local workers. However, technological innovation may be just as likely to reduce workforce requirements, with negative impacts on employment and livelihoods potentially pushing people into more destructive practices. Target 14.A suggests that knowledge and technology can only be created through research by key gatekeepers and then transmitted to those on the ground; this disregards the huge contribution of traditional ecological knowledge and the capacity of local and Indigenous communities to improve fisheries and coastal management.

14.3.8 Provide Access for Small-scale Artisanal Fishers to Marine Resources and Markets – Target 14.B

Target 14.B is an important way to improve local livelihoods and increase environmental justice by securing access to marine resources (such as fish) and markets that allow monetising those ecological benefits. As reflected in Indicator 14.B.1, this is most likely to be achieved in a top-down manner by legislative reform that encourages the transfer of marine resource rights to local communities. Improving market access requires more transparency in supply chains and technology investments that give local communities access to market information (e.g. mobile phone platforms to communicate market prices).

ANTICIPATED IMPACTS ON MANGROVES

Community-based mangrove management can have positive benefits for mangrove area and health since management is placed in the hands of resource users who know the local context and communities have an incentive to conserve their own resources (Friess et al. 2016a, Sudtongkong and Webb 2008). So, increasing regulatory and institutional frameworks that recognise community access rights are welcome, especially if such frameworks are able to incentivise and enforce sustainable management by local communities. Target 14.B may have mixed small-scale impacts on mangrove-related fisheries, as increasing resource access may promote more people to undertake fishing activities. This could lead to (shell)fish population declines if not properly and equitably managed. The broader mangrove ecosystem can be negatively impacted if trees are harvested for poles and other artisanal fishing infrastructure.

ACTORS INVOLVED OR AFFECTED

The hope is that this SDG target will have the intended positive impacts on local community actors by increasing livelihoods through more direct connections to markets. Increasing resource access and market access are also positive outcomes for environmental justice, giving local communities more control over their local resources and their livelihoods. However, success is most likely when there are strong local–state relationships and co-management (see examples presented by Defeo et al. 2016 in Latin America), so that appropriate, equitable and enforceable frameworks can be drafted. For frameworks to be equitable, they need to address benefit sharing and gender issues, as women are key collectors of (shell)fish and forest products as well as being heavily involved in their processing (Lau and Scales 2016). However, frameworks that focus on fishing practices alone may ignore these contributions.

14.3.9 Enhance Conservation and Sustainable Management through UNCLOS – Target 14.C

Articles 61 and 62 of the UN Convention on the Law of the Sea (UNCLOS) describe countries' obligations for the conservation and use of living marine resources within the exclusive economic zone. The conservation of biodiversity and protection of marine habitats are obligations under Article 194. Articles 117–19 describe obligations for the conservation of living resources in the high seas; Articles 207–12 address pollution from the land, sea and atmosphere. Migratory and straddling fish stocks are also considered under UNCLOS.

As per the indicator for Target 14.C, most mangrove-holding countries have already ratified UNCLOS (Cambodia, Colombia, El Salvador, Iran, the United Arab Emirates and the USA have signed but not ratified; Eritrea, Peru and Venezuela have done neither). Thus, this target is most likely to have an impact by focusing on the implementation of UNCLOS principles that promote incorporation of mangrove conservation into national laws.

ANTICIPATED IMPACTS ON MANGROVES

Mangroves are not explicitly considered under UNCLOS, but may be indirectly addressed since UNCLOS serves as a framework for the Convention on Biological Diversity and also the Ramsar Convention, both of which cover mangrove forests. UNCLOS has been used to enforce conservation of connected populations. While this has largely focused on globally connected fisheries (e.g. tuna), mangroves and the organisms that reside within them are also connected by sea and could fall under this remit. Due to these connections, UNCLOS can be used as a framework for regional cooperation on conservation (Ramesh et al. 2017). Articles that consider the impacts of pollution are particularly relevant, such as oil pollution, which can cause considerable damage within mangroves (Duke 2016), and other pollutants, whether from sea or land. Thus, we consider that this SDG target will have largely positive impacts on mangroves if mangroves and their inshore areas are explicitly considered.

ACTORS INVOLVED OR AFFECTED

Target 14C involves actors at multiple hierarchical levels, particularly national and international stakeholders involved in the implementation of UNCLOS principles into national policies. Though these stakeholders are not impacted, they play an important implementation role. Conversely, local communities may not play an important implementation role, but they are impacted by these national policies. Local communities will benefit from a less-polluted coastal environment; however, pollution controls should not

inadvertently restrict or harm local community activities along the coast. Local communities may also benefit from the fisheries protection aims of UNCLOS, though in reality these are most appropriate for high-seas fisheries outside of a country's exclusive economic zone, and may have little relevance to coastal communities.

14.4 General Themes Regarding the Impact of SDG 14 on Coastal Forests

Three strong themes emerge across all SDG 14 targets that increase the risk of adverse consequences to coastal forested ecosystems.

14.4.1. Lack of Focus on Coastal Forested Ecosystems

Coastal forested ecosystems need explicit consideration within SDG 14. The focus on fisheries leans towards marine rather than coastal ecosystems. A focus on fisheries is rightly important, because fisheries are heavily threatened globally, with important implications for development and the environment. However, this chapter shows examples of how this focus may have unintended consequences on forested ecosystems that directly and indirectly support fisheries. Target 14.6 provides a pertinent example: this target is solely focused on fisheries, and the Indicator of 'implementation of international instruments aiming to combat illegal, unreported and unregulated *fishing*' suggests a focus on fishing. However, subsidies for land-based fish production (e.g. tax breaks for aquaculture) are huge drivers of mangrove deforestation. The removal of aquaculture subsidies may encourage other forms of agriculture that are now more financially viable. We are already seeing this in Southeast Asia, with the emergence of oil palm as a driver of mangrove deforestation (Richards and Friess 2016). Other SDG targets implicitly bias management efforts towards fisheries, such as the creation of VLMPAs (Target 14.5) at the expense of smaller, coastal MPAs that incorporate mangroves, or focusing on sustainable fisheries management (Target 14.7), though the latter has huge potential application to other mangrove ecosystem services. Mangroves can make an important contribution to SDG 14, but they have to be included.

14.4.2 A Marine Focus of SDG 14 Misses Important Linkages

Only Target 14.1 considers terrestrial–marine linkages, through upstream pollution. This is a problem because it is more than just pollution that connects the terrestrial and marine zones; they are also connected by sediments,

financial flows, community uses and governance arrangements. This disconnection also means that some forest types are not considered; for example, terrestrial forests co-located along the coast are excluded, because they would be managed under SDG 15 (Life on Land), though they may be impacted by SDG 14. Of all the SDGs, SDG 14 and 15 (alongside SDG 11 Sustainable Cities and Communities) stand out because they are the only explicit system- or location-based SDGs. The other SDGs are sectoral (e.g. governance, poverty, education, gender equality), and as such can be incorporated more widely into the other SDGs.

14.4.3. The Importance of Multi-Stakeholder Engagement

SDGs are most likely to be implemented by national-level state actors, as they are the signatories to the SDGs and associated conventions and are well-placed to mainstream the SDGs into national development and environmental conservation planning. However, many of the impacts of SDG 14 discussed here are exacerbated by the dominance of top-down governance. Multi-stakeholder collaboration and engagement may make it more likely to anticipate negative impacts of SDG 14 on coastal communities. Many tropical countries have decentralised natural resource governance over the past few decades, which has increased the success of conservation and sustainable management actions, particularly for mangroves (Sudtongkong and Webb 2008). Linked to this, environmental justice for local communities is another theme that emerges from this chapter, with clear links to decentralisation. Policies and management actions that ensure equitable access to ecosystem benefits are likely to discourage some of the negative and unintended impacts of SDG 14 outlined here, indicating the importance of incorporating principles of SDG 16 (Peace, Justice and Institutions) into all the SDGs.

14.5 Synergies and Trade-Offs

While a full analysis is beyond the scope of this chapter, it is clear that coastal forests can contribute to all SDGs (Ramsar 2018). Likewise, many SDGs can have positive, synergistic effects on SDG 14 targets and mangroves. However, they are also likely to be antagonistic to mangrove conservation and management in some settings.

SDG14's focus on fisheries can contribute to achieving SDG1 (No Poverty) (e.g. Coulthard et al. 2011). However, trade-offs are envisaged, because increasing livelihoods can lead to greater environmental degradation, as in the Madagascar example given earlier (Scales et al. 2018). Other examples exist of environmental degradation driven by projects that increase coastal

livelihoods, for example through aquaculture or linking fisheries to international markets (e.g. Armitage and Johnson 2006). As such, efforts to increase livelihoods to achieve SDG 1 can go against sustainable resource use required by SDG 14.2.

Mangroves and the goals of SDG 14 can also contribute to achieving SDG 2 (Zero Hunger) due to their important role in the food security of coastal communities. However, there is potential for conflicts among SDG 2 and SDG 14 targets such as 14.2, 14.5 and 14.6 because mangroves continue to be converted to rice agriculture and aquaculture, incentivised by government tax breaks, subsidies and production targets for food security. Most recently, Indonesia and Malaysia have ambitious short- and medium-term plans to increase palm oil production. This is expected to expand current mangrove deforestation frontiers into new areas such as Papua, Indonesia (Richards and Friess 2016).

A push to achieve SDG 2 will indirectly impact mangroves and fisheries. Soil erosion related to land-cover change increases sediment load in water courses that drain into the coastal zone, which at high magnitudes is detrimental to mangroves due to pneumatophore smothering (Sidik et al. 2016). Increased suspended sediment concentrations have negative impacts on mangrove-associated fisheries. Agricultural intensification to achieve SDG 2 is likely to increase eutrophication in downstream coastal waters, with low dissolved oxygen affecting coastal flora and fauna.

SDG 11 (Sustainable Cities and Communities) can positively impact urban mangroves. Some of the largest cities in the tropics occur in mangrove-rich deltas, such as the Chao Phraya (Bangkok, Thailand) and the Mekong (Ho Chi Minh, Vietnam) (Tessler et al. 2015). Other large coastal cities, such as Mumbai, Singapore and Hong Kong, have substantial mangroves. Maintaining mangroves within urban landscapes has multiple benefits, including coastal protection, flood control, nutrient processing, carbon storage and cultural services (Everard et al. 2014, Friess et al. 2016b). However, degraded coastal wetlands within city landscapes can also be sources of contaminated seafood (Dsikowitzky et al. 2011) and habitats for mosquitoes (Claflin and Webb 2017), which may reduce their amenity within urban landscapes.

SDG 15 (Life on Land) is highly synergistic with coastal forests, located in the transition between the terrestrial and marine realms, including a transitional space for many terrestrial faunal species. Mangroves rely on terrestrial connections; restoring rivers and their freshwater and sediment fluxes to the coastal oceans enhances mangrove resilience to sea-level rises (Lovelock et al. 2015). However, their position between the terrestrial and marine spheres means that mangroves may fall through the policy gap in many countries (Friess et al. 2016a, Primavera 2000), with some government agencies considering them neither terrestrial (SDG 15) nor marine (SDG 14).

14.6 Conclusions

Coastal forested ecosystems such as mangrove forests are strongly linked to poverty and development since they provide ecosystem services to potentially hundreds of millions of people. An SDG focused on coastal and marine ecosystems – the life below water – is therefore encouraging. However, SDG 14 is likely to have indirect and unintended consequences for the very ecosystems it aims to protect and the local communities that rely on them. Anticipating negative consequences requires thinking and planning at multiple scales and a multidisciplinary view of SDG 14 implementation that incorporates multiple stakeholders at different hierarchical levels. Ultimately, many SDG 14 targets require increasing local environmental justice and resource management.

We need to more explicitly consider coastal forested ecosystems within SDG 14, as not doing so may explain the potential for unintended consequences on coastal forests. Ultimately, coastal and marine ecosystems face challenges when forced into one SDG, so there is high potential for conflict. A stronger recognition of the unique challenges of the coastal zone, and coastal forested ecosystems in particular, throughout all SDGs may raise their profile so that they can be more strongly considered in conservation and development planning.

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