15SM

Small Islands
Supplementary Material

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SM15.1 Key Risks

Table SM15.1 | Summary of adaptation options to key risks identified for small islands.

Key risks	Risk-oriented adaptation options	Evidence and Agreement	Degree of implementation with illustrative small island examples	Key enablers	Reduces exposure and vulnerability: yes/no with illustrative examples	Overarching adaptation options supporting implementation and success	Co-benefits	Disbenefits
KR1. Loss of marine and coastal biodiversity and ecosystem services	**EbA measures (15.4.4).** Marine protected areas (MPAs), including paired terrestrial and marine protected areas aimed at preventing marine ecosystem degradation, and enhancing climate resilience (Bates et al., 2019; Carlson et al., 2019).	*Medium evidence, low agreement* (with regard to CC adaptation and benefits)	Widespread across small island regions. Some of the largest MPAs globally have been designated around small islands (e.g., Chagos, Hawaii, Galapagos, Cook Islands, Pitcairn). Some advocated for climate resilience purposes, e.g., Pacific islands (McLeod et al., 2019), including Fiji and Papua New Guinea (Le Cornu et al., 2018).	Strong governance and sufficient financial resources to allow for adequate management and enforcement (Schleicher et al., 2019)	Restricting human activities through MPAs is assumed to create more resilient biological communities with a greater capacity to resist and recover following climate events. Yet species protected from activities such as fishing can also be vulnerable to climate stressors – the 'Protection Paradox' (see Bates et al., 2019).		Secondary benefits for marine biodiversity and coastal economies. Support to food supply. Increased human health and well-being.	
	EbA measures (15.4.4). Active restoration of coastal and marine ecosystems (e.g., coral reefs, mangrove forests and seagrass meadows)	*Limited evidence, low agreement* (with regard to long-term success)	Replanting of mangroves or seagrasses and transplantation of corals is becoming common practice in small islands although often only at a small scale. For example, artificial reefs are found in the Maldives (Fabian et al., 2013) and in Mauritius (Duvat et al., 2020a); beach nourishment in Tuvalu (Onaka et al., 2017) and Mauritius (Onaka et al., 2015); vegetation planting in Fiji (Veitayaki and Holland, 2017) and Sicily (Alagna et al., 2019). Coral reefs and seagrass are among the most expensive ecosystems to restore. Mangrove restoration projects were typically the largest and the least expensive per ha. The overall success of restoration projects is variable, in particular success of seagrass replanting is typically relatively low (~38%) worldwide (Bayraktarov et al., 2016).	Adaptation taxes and levies imposed on tourism can provide funding for restoration and protection, e.g., in the British Virgin Islands. Blue bonds are an innovative ocean financing instrument whereby funds raised in international markets are earmarked exclusively for projects deemed 'ocean-friendly' (e.g., Seychelles and Grenada). In the Seychelles, coral restoration programmes and mangrove reforestation are promoted through public–private partnerships, generating opportunities for wetland tourism (Khan and Amelie, 2015).	Active intervention in the form of habitat recreation is assumed to enhance resilience of natural ecosystems, thereby reducing their vulnerability.		Improve water quality; reduction in coastal erosion and flood risks since vegetated habitats (and intact coral reefs) help to dissipate wave energy and to protect coastlines; economic benefits.	

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KR1. Loss of marine and coastal biodiversity and ecosystem services	**Hard protection (15.5.1).** Hard shoreline structures sometimes designed to also enhance marine biodiversity	*Medium evidence, medium agreement*	Artificial reefs have been increasingly used in small islands to support reef restoration and reduce beach erosion, e.g., in the Maldives (Fabian et al., 2013), in Mauritius (Duvat et al., 2020a), in Antigua (Cummings et al., 2015).	Adaptation taxes and levies imposed on tourism can provide funding for restoration and protection, e.g., British Virgin Islands. In the Caribbean, fiscal instruments are used such as environmental taxes and levies but there is *limited evidence* of direct reinvestment in conservation and management (Attzs et al., 2014; CANARI, 2020)	Uncertainty on reduction of exposure and vulnerability of marine ecosystems. Usually implemented in order to reduce exposure of human assets/infrastructure, with secondary benefits for marine and coastal biodiversity. Sometimes left as substrates for passive colonisation by marine species (e.g., fish and corals), elsewhere has been introduced alongside active transplantation of coral colonies.		Support to food supply. Secondary benefits for coastal economies (can be a tourism asset in its own right). Increased human health and well-being.	
	Diversifying livelihoods (15.5.6). Diversifying fisheries livelihoods (e.g., to aquaculture and tourism), changing fishing grounds and/or target species	*Limited* to *medium evidence, medium agreement*	Examples in the Caribbean and Pacific: wide range of activities ranging from diversification of livelihoods to changing fishing grounds and target species, e.g., to take pressure off vulnerable coastal species, e.g., in Antigua, Dominican Republic, and Efate (Vanuatu) (Blair and Momtaz, 2018; Lemahieu et al., 2018; Karlsson and McLean, 2020; Turner et al., 2020).	Improved governance/cooperation, e.g., a regional strategy to improve coastal fisheries management in a changing climate. Weather insurance to facilitate recovery after an extreme event and enhance resilience, e.g., in Saint Lucia and Grenada via the Caribbean Oceans and Aquaculture Sustainability Facility (Sainsbury et al., 2019)	Yes, in both Antiqua and Vanuatu (Blair and Momtaz, 2018). New fishing areas in Vanuatu (Blair and Momtaz, 2018) and fishermen go further offshore in Madagascar (Lemahieu et al., 2018) and Dominican Republic (Karlsson and McLean, 2020). A directed switch from targeting vulnerable inshore reef fish, to targeting less sensitive offshore pelagic species, e.g., in Dominica (Pinnegar et al., 2019). Active switch to aquaculture (away from fisheries) to diversify incomes and spread risks, e.g., Caribbean (Thomas et al., 2019), Solomon Islands (Dey et al., 2016) including a move toward seaweed farming (e.g., St Lucia).		Sustainably managed fisheries, improved food and income security. Greater economic and societal resilience.	

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KR1. Loss of marine and coastal biodiversity and ecosystem services	**Reef-to-ridge ecosystem management (Figure 15.4).** Improved land use as a key driver of marine ecosystem health: better management of forests, nutrients and wastewater in upstream catchments	*Limited evidence, medium agreement*	Mostly in the Caribbean and Pacific, where ridge-to-reef studies are currently focused e.g., (Brown et al., 2017; Delevaux et al., 2018a; Delevaux et al., 2018b); however, not so much within the Indo-Pacific islands (Rude et al., 2016; Brown et al., 2017). Better forest management in upstream catchments (and thereby control of sediment run-off) can greatly benefit coral reef condition around islands, e.g., Kubulau District, Fiji (Delevaux et al., 2018a), Raja Ampat, Indonesia (Rude et al., 2016).	Improved governance	Better management of forests, nutrients and wastewater in upland catchments reduces the exposure of coral reefs to human degradation, thereby enhancing their resilience, e.g., Hāʻena and Kaʻūpūlehu in the Hawaiian Archipelago (Delevaux et al., 2018b), American Samoa (Comeros-Raynal et al., 2017).		Improved ecosystem protection services, e.g., against flooding, erosion, landslides, mudflows; improved biodiversity; improved human health outcomes; improved livelihoods	
KR3. Loss of terrestrial biodiversity and ecosystem services	**Decreased deforestation (15.5.4)**	*Limited* to *medium evidence, high agreement*	Mostly in the Caribbean region and Pacific, e.g., in Papua New Guinea (Jupiter et al., 2014), Fiji (Hidalgo et al., 2021), Jamaica (SPCR, 2011) (UNDP, 2012), Hispaniola (GIZ, 2011)	National determined contributions, external funding (e.g., international NGOs), engagement of local landowners, gender-sensitive participation, resolution of land ownership governance issues, long-term approaches to account for recovery between extreme weather events and disturbance, maintained connectivity between social and ecological systems, ensured long-term funding (Jupiter et al., 2014), economic incentive for tree planting (Hidalgo et al., 2021)	**Some examples:** e.g., increase in forest extent, social benefits in pilot but limited by barriers in implementation (Buckwell et al., 2019), increased acreage forested (SPCR, 2011), reduction in human exposure to natural disasters (hurricanes, landslides), improvement in vulnerability assessment scores (UNDP, 2012)	Mainstreaming into national policies (Robinson, 2017), filling data gaps, e.g., flora and fauna baseline data (Voccia, 2011; Klöck and Finch, 2019), Integrated island management and cross-sectoral (Jupiter et al., 2014), regular monitoring and evaluation (Mercer et al., 2012); long-term sustainability, greater recognition of importance of diverse range of ecosystems, especially terrestrial (McNamara et al., 2020)	Increased connectivity between forest fragments (Buckwell et al., 2019), sustainable livelihoods (SPCR, 2011), reduced soil erosion (UNDP, 2012), reduced emissions (UNDP, 2012), improved soil health (GIZ, 2011), decreased poverty (GIZ, 2011), improved livelihoods and environmental awareness, improved water supply, health and sanitation (Hidalgo et al., 2021); supports global mitigation via carbon sequestration in both forest and soils	Little evidence that disbenefits have been considered in adaptation actions more generally (Robinson, 2017)

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KR3. Loss of terrestrial biodiversity and ecosystem services	**EbA: Increased reforestation** (native species—towards habitat connectivity, heterogeneity and diversity) (15.5.4)	*Medium evidence, high agreement*	Relatively widespread, e.g., Dominican Republic (Monty et al., 2016); Jamaica (SPCR, 2011); Fiji (Daigneault et al., 2016); Tuvalu, Tonga, Samoa (Beyerl et al., 2018); Timor-Leste (Mercer et al., 2014), Micronesia (Hagedoorn et al., 2019).	Locally driven projects tend to yield effective adaptation when externally driven (Klöck and Finch, 2019), embedding adaptation within disaster risk reduction, e.g., ecosystem-based DRR (Mercer et al., 2014; Monty et al., 2016), NDC, funding, technical assistance, supply materials, provision of land, awareness raising, enforcement of policies from governments and NGOs (Beyerl et al., 2018), sense of shared responsibility (Beyerl et al., 2018), inclusion of Indigenous knowledge and local knowledge (IKLK) (Nalau et al., 2018), social capital (Hagedoorn et al., 2019).	**Some examples:** e.g., Fiji (Daigneault et al., 2016), but generally *limited evidence* and tendency for lack of sustainability of projects, investment in expensive pilot projects (Jupiter et al., 2014) and lack of long-term monitoring.		Increased DRR, fewer floods and landslides (Mercer et al., 2014), reduced erosion, increased human health and well-being (Beyerl et al., 2018) (Nalau et al., 2018), increased quality of ecosystem services (Nalau et al., 2018), increased adaptive capacity (Hagedoorn et al., 2019); supports global mitigation via carbon sequestration in both forest and soils	
	EbA: Agroforestry and other silvicultural/ agroecological practices (e.g., climate-smart agriculture) instead of intensive agriculture and plantation forestry (15.5.4)	*Medium evidence, high agreement*	Widespread in the Caribbean and Pacific, e.g., Samoa (Chong, 2014), Vanuatu (Buckwell et al., 2019), Pacific Islands (McLeod et al., 2019; McNamara et al., 2020), Jamaica (Tomlinson and Rhiney, 2017)	Locally funded initiatives implemented by NGOs outperformed those with international funding or implemented by governments and universities, integrated with EbA initiatives outperformed those focused on land loss, NDC, shared access and benefit (McNamara et al., 2020), local knowledge, e.g., farmers knowledge of crop drought resistance and irrigation, although some local knowledge is counter to SDGs (Beckford, 2018), farmers, private sector for developing technology, financing and investing in local solutions, importance of data (Voccia, 2011). Success of EbA depends on enabling national political, socioeconomic and institutional conditions (Chong, 2014), training (Tomlinson and Rhiney, 2017).	**Limited examples:** some increases in adaptive capacity (Tomlinson and Rhiney, 2017)		Improvement in climate change awareness, increase local well-being and improved non-climate issues, improve gender equity (McNamara et al., 2020), improved productivity and livelihoods, increased well-being (Buckwell et al., 2019)	

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KR3. Loss of terrestrial biodiversity and ecosystem services	**Watershed management/ conservation** (reforestation, slope revegetation, etc) (15.5.4)	*Medium evidence, high agreement*	Widespread, e.g., Samoa (Chong, 2014); Pacific Islands (McNamara et al., 2020); Jamaica, Haiti and Grenada (Mercer et al., 2012); Micronesia (McLeod et al., 2019).	Locally funded initiatives implemented by NGOs outperformed those with international funding or implemented by governments and universities, integrated with EbA initiatives outperformed those focused on land loss, shared access and benefit (McNamara et al., 2020), *but* watershed management less socially and politically acceptable than engineering solutions (Enríquez-de-Salamanca, 2018), communication and trust between stakeholders, sustainable financing mechanisms (Mercer et al., 2012), island remoteness barrier to logistical implementation (McLeod et al., 2019).	Some evidence, e.g., improved water security (McLeod et al., 2019), reduced adaptation costs, slope stabilisation (Mercer et al., 2012), reduced vulnerability to drought (McLeod et al., 2019)		DRR, increased water security and quality, greater resiliency to and recovery from wildfires, reduced run-off and sedimentation, improvement in climate change awareness, increased local well-being and financial stability (McNamara et al., 2020)	
	Ridge-to-reef ecosystem management (Figure 15.4) — improved land use as a key driver of terrestrial ecosystem health	*Medium evidence, high agreement*	See above	See above	*Limited but slowly increasing evidence* to date			

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KR3. Loss of terrestrial biodiversity and ecosystem services	**Increasing the connectivity of Protected Areas (PAs) across elevation/ climatic gradients** to facilitate climate-driven redistribution of species via establishment of: (a) new PAs; (b forested migration corridors across elevation/ climatic gradients or (c) improving landscape connectivity by permanent protection of stepping stones (Figure 15.4)	*Very limited evidence, high agreement*	Low degree of new implementations due to chronic terrain limitations combined with competition from human land use needs (especially at low altitudes). However, there is currently large variation in terrestrial PA coverage among islands (e.g., Caribbean: ~70% of Guadeloupe vs 1.3% of Barbados) (Gould et al., 2020; Mouillot et al., 2020).	(a) Conservation of larger areas of forest habitat surrounding (especially source) PAs; (b) reforestation of degraded areas to facilitate forest corridors; (c) increasing and enforcement of forest cover *within* PAs (e.g., Scriven et al., 2015), (d) intra- and inter-governmental/island policies towards the coordination of conservation actions/partnerships among multiple PAs *and other non-PA natural habitat areas* within a given insular region (Monahan and Theobald, 2018; Maharaj et al., 2019); incorporation of Other Effective area-based Conservation Measures (OECMs)	Yes, especially if landscape connectivity is improved (both protected and non-protected land). For example, setting up of migration corridors to facilitate movement of species along elevation gradients from isolated low-altitude to high-altitude PA (e.g., Scriven et al., 2015)		DRR, improved water security, improved coastal ecosystem health, greater resiliency and recovery from wildfires, reduced pollution and runoff around water sources, facilitates development of ridge-to-reef PAs (e.g., Yap and Chuuk of Federated States of Micronesia) (McLeod et al., 2019).	May facilitate movement of IAS
	Eradication of IAS on islands (15.3.3.3)	*Robust evidence, high agreement*	Widespread degree of implementation with > 700 islands (e.g., Jones et al., 2016)	(a) Integration of changing climate conditions within ongoing prevention, control and eradication strategies by incorporating models of current and future distributions of IAS (Courchamp et al., 2014; Vorsino et al., 2014) (b) prevention via ongoing vigilance and biosecurity via quarantine, control and monitoring of incoming cargo and goods into islands (Silva-Rocha et al., 2015)	Yes, positive demographic and distributional responses of native species (596 populations), including within IUCN's threatened (critically endangered, endangered and vulnerable categories) following eradication of IAS (including 123 recolonizations by formerly extirpated species) (Jones et al., 2016)		Food security, protection of ecosystem health and services, increased livelihood security	A few native species may be harmed during eradication process—but usually temporary, and is alleviated once eradication process is completed (Jones et al., 2016)

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KR4. Water insecurity	Rainwater harvesting (15.3.4.3)	*Robust evidence, high agreement*	Widespread across small islands. Specific examples in the Caribbean: Jamaica (Aladenola et al., 2016); Barbuda (Mycoo, 2018b); in the Pacific (Quigley et al., 2016); Micronesia (Bailey et al., 2018); Solomon Islands (Chan et al., 2020).	Sociocultural and financial–cultural practices and poverty—people may not have the resources to build or purchase more tanks to increase their capacity to store water (McCubbin et al., 2015).	Yes, heavy reliance on aquifers and rainwater harvesting in small islands, particularly atolls, coupled with overcrowding, population growth, and contamination increase the risk of water-borne disease (McIver et al., 2014).	Integrated water resource management—use management and integrated water resources policy implementation (Gohar et al., 2019). Governance—whole-of-island approaches foster integrated management practices in small islands (Remling and Veitayaki, 2016).	Biodiversity (watershed protection); health (WASH); economic (reduced dependence on public supply); food security	Dependent on mode of implementation. Nothing mentioned in the chapter.
	Desalination (15.6.1)	*Limited evidence, high agreement*	Relatively limited, e.g., Maldives (Shakeela and Becken, 2015); Grenada (Peters, 2019)	Financial, not explicitly mentioned in the chapter. These general references are possible options: Governance, financial arrangements and human resource capacity [are key] to the successful implement adaptation actions on the ground (Cvitanovic et al., 2016; Scobie, 2016; Beckford, 2018; Ha'apio et al., 2019). In Mauritius, a lack of financial resources for climate change adaptation has been recognised as a specific impediment in district council level (Williams et al., 2020).	Yes, in Barbados, where groundwater is relied upon for food production, urban use, and environmental needs, higher food prices are expected in the future if informed land use management and integrated water resources policy implementation are not put in place to manage groundwater in the short term, even with modest climate change threats (Gohar et al., 2019).		Health (WASH); economic (reduced dependence on public supply)	Energy intensive (carbon footprint)
	Reforestation (15.5.4)	*Medium evidence, high agreement*	Examples in the Caribbean and Pacific: Caribbean (McMillen et al., 2016; Mycoo and Donovan, 2017; Wang et al., 2017; McLeod et al., 2019; Nanni et al., 2019); Papua New Guinea (Jupiter et al., 2014); Fiji (Hidalgo et al., 2021).	Governance—whole-of-island approaches foster integrated management practices in small islands (Remling and Veitayaki, 2016).	Yes, in the Seychelles, reforestation is promoted through public–private partnerships, generating opportunities for wetland-tourism (Khan and Amelie, 2015). Growing evidence suggests high resilience of forest habitats (Keppel et al., 2014; Luke et al., 2017), especially within intact forest ecosystems to hurricanes and cyclones (Goulding et al., 2016).		Economic (agroforestry); biodiversity (watershed restoration); food security; disaster risk reduction (DRR)	Dependent on mode of implementation. Nothing mentioned in the chapter.

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KR4. Water insecurity	Protected area management (terrestrial) (15.5.4)	*Medium evidence, high agreement*	Widespread across small islands, e.g., Samoa (Chong, 2014); Pacific Islands (McNamara et al., 2020); Jamaica, Haiti and Grenada (Mercer et al., 2012); Micronesia (McLeod et al., 2019).	Financial/governance—the success of protected areas is undermined by weak governance due in part to limited financial resources which undermine management and the enforcement of regulations governing activity within them (Schleicher et al., 2019).	Yes, terrestrial protected areas have shown that forest conservation and rehabilitation yield better (socioecological) outcomes as forests stabilize soils and prevent erosion and sequester groundwater pollutants (Carlson et al., 2019) (*low-to-medium evidence, high agreement*).		Biodiversity (forest conservation); DRR	Dependent on mode of implementation. Nothing mentioned in the chapter.
KR5. Destruction of settlements and infrastructure; n.b.: works for submergence of reef islands, at least for those islands that host large communities and human assets	**Hard protection (15.5.1)**	*Limited evidence, medium agreement* (with regard to climate change adaptation and success)	Widespread in both urban and rural areas on islands, e.g., Barbados (Mycoo, 2014, French Polynesia (Salmon, 2019; Duvat et al., 2020b), Maldives (Naylor, 2015; Brown et al., 2020), Samoa (Crichton and Esteban, 2018).	External funding (Mycoo, 2018a; Nunn and Kumar, 2018). Social and cultural: hard protection often meets the preference of inhabitants because it is viewed as a 'true' and permanent solution providing value for money, e.g., in the Maldives (Shaig, 2011), in Samoa (Hills et al., 2013), in Comoros (Betzold and Mohamed, 2017). Political–institutional: e.g., supported by the centralization of power at the highest levels of government in favour of hard protection in the Maldives (Ratter et al., 2019); business-as-usual unidirectional approach of coastal risks is in favour of hard protection on Reunion Island (Magnan and Duvat, 2018). Technical, i.e., requires materials and technical skills to be available locally: maladaptive structures showing poor design in the Bahamas (Petzold et al., 2018), Maldives (Kench, 2012), Kiribati (Duvat, 2013) and Samoa (Crichton and Esteban, 2018).	Reduces exposure in some places, e.g., Malé, Maldives (Duvat et al., 2021) but not in others, e.g., South Tarawa, Kiribati (Duvat, 2013), Puerto Rico (Jackson et al., 2012); increases vulnerability (Nunn et al., 2021)	Limited monitoring and evaluation. What works in short term may not in the long term.	*Limited evidence* of co-benefits	Beach loss, e.g., in Hawaii (Romine and Fletcher, 2013) and Papua New Guinea (Mann, 2014); erosion acceleration, e.g., on Malé Atoll, Maldives (Rasheed et al., 2020) and in the Bahamas (Petzold et al., 2018); nearby ecosystem degradation through material extraction from reef flat and/or upper beach and/or sand dune, e.g., in South Tarawa, Kiribati (Biribo and Woodroffe, 2013; Duvat, 2013); modelling projects increased SLR impacts in areas modified by coastal engineering, e.g., on Malé Atoll, Maldives (Rasheed et al., 2020)

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KR5. Destruction of settlements and infrastructure; n.b.: works for submergence of reef islands, at least for those islands that host large communities and human assets	**Accommoda-tion (15.5.2)**	*Limited evidence* (with regard to climate change adaptation and success)	Relatively limited (e.g., local initiatives in Philippines and Indonesia (Jamero et al., 2017; Esteban et al., 2020)	Technological, financial, institutional, social and cultural (e.g., limited success despite incentives in French Polynesia; (Magnan et al., 2018))	*Limited evidence* to date		Maintains the functionalities of coastal systems and enables their maintenance through landward migration under SLR	
	Advance with land raising and/or through the creation of artificial islands (15.5.2)	*Limited evidence* with regard to climate change adaptation (e.g., driven by population growth in the Maldives; Naylor, 2015)	Limited, e.g., Hulhumalé, Maldives (Brown et al., 2020)	Technological, financial, institutional, social and cultural; has a higher potential in urban (compared to rural) areas	Yes, where high standard, as in Hulhumalé, Maldives (Brown et al., 2020)		Offers new land for economic development, e.g., in the Maldives (Hinkel et al., 2018); generate revenues through sale or lease of land in urban areas, e.g., in the Maldives (Bisaro et al., 2019).	Widespread ecosystem destruction, increased negative impacts of SLR in some places (Parnell and Smithers, 2020)
	Migration, including planned resettlement (15.5.3)	*Limited evidence, low agreement* (with regard to climate change adaptation)	Village-scale planned resettlement cases supported by government policy/ legislation, e.g., Warraber Island, Torres Strait (Parnell and Smithers, 2020), Vunidogoloa and Denimanu villages, Fiji (Piggott-McKellar et al., 2019)	Often seen as a last-resort option due to high economic and sociocultural cost (McNamara and Des Combes, 2015); key enablers: participatory inclusion of all social groups in decision making required (e.g., Fiji, (Piggott-McKellar et al., 2019); financial, especially for small and remote communities e.g., Torres Strait, Australia; (Parnell and Smithers, 2020) Solomon Islands (Albert et al., 2018), social-cultural connections e.g., Fiji, (Piggott-McKellar et al., 2019), strong governance frameworks, enabling legislation, land availability or ownership e.g., Torres Strait Islands, Australia; (Parnell and Smithers, 2020), Solomon Islands, (Albert et al., 2018; Bertana, 2020) and conditions in receiving locations; technical support; residents are generally reluctant to retreat as a result of place attachment and high uncertainties on the conditions offered at relocation site, including concerns about livelihood opportunities, as reported in the Philippines (Jamero et al., 2017)	Limited examples of successful resettlement that reduces both exposure and vulnerability; reduced exposure locally, e.g., on Nuatambu Island, Solomon Islands (Albert et al., 2018); has created new vulnerabilities at some locations by, for example, bearing significant economic cost, impacting social capital, reducing access to services (e.g., (Albert et al., 2018); Gilbertese resettled in the Solomon Islands; (Weber, 2016; Tabe, 2019)		New livelihood opportunities	Loss of cultural heritage, impacts on receiving communities

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KR5. Destruction of settlements and infrastructure; n.b.: works for submergence of reef islands, at least for those islands that host large communities and human assets	**EbA measures (15.5.4)**	*Medium agreement, medium evidence*	Increasingly experienced; includes artificial reefs, e.g., in the Maldives (Fabian et al., 2013) and in Mauritius (Duvat et al., 2020a), beach nourishment in Tuvalu (Onaka et al., 2017) and Mauritius (Onaka et al., 2015)	Environmental/physical conditions: potential effectiveness varies with site configuration and boundary conditions (Temmerman et al., 2013); social and cultural; technological; major role of cooperation agencies/external support for implementation, e.g., JICA in Tuvalu (Onaka et al., 2017) and in Mauritius (Onaka et al., 2015) and of NGOs (in the Caribbean region (Mercer et al., 2012)); IKLK (e.g., Pacific, (Nalau, 2018); Haiti, (Mercer et al., 2012)); financial (Nalau, 2018); climate awareness raising increases success (McNamara et al., 2020); inclusion in national adaptation policies increases the acceptance/implementation of EbA measures: e.g., considered as a complement to hard protection in Tuvalu; vegetation restoration seen as a key priority to combat erosion in Vanuatu (Hills et al., 2013)	*Limited evidence* to date		Biodiversity strengthening; increased food supply; increased human health and well-being	
KR6. Health degradation	**Increase public awareness of health risks** associated with climate change; **provide training to health sector staff** on health impacts of climate change; **Improve reliability and safety of water storage practices** at household and community level (15.6.2)	*Limited evidence*	For example, Dominica (Schnitter et al., 2019)	Financial and human resources to implement options, public uptake and buy in	Primarily reduces vulnerability	Building early warning and response systems for climate-sensitive health risks, developing emergency plans, integrating climate services into health decision-making systems, strengthening emergency response and surge capacity, improving climate change and health data collection systems (Schnitter et al., 2019)	Increased water security	

Key risks	Risk-oriented adaptation options	Evidence and Agreement	Degree of implementation with illustrative small island examples	Key enablers	Reduces exposure and vulnerability: yes/no with illustrative examples	Overarching adaptation options supporting implementation and success	Co-benefits	Disbenefits
KR7. Economic decline and livelihood failure	**Circular migration (15.5.3)**	*Limited evidence* with regard to climate change adaptation (mostly a response to economic or social factors)	Circular migration to Funafuti and locations overseas from Nanumea Atoll in Tuvalu reduces pressure on limited freshwater availability, thus reducing exposure to drought (Marino and Lazrus, 2015).	Labour and education opportunities in Funafuti and overseas (Marino and Lazrus, 2015)	Yes, on Nanumea Atoll (Marino and Lazrus, 2015)	Investment in technology and education (Blair and Momtaz, 2018), local and indigenous knowledge (Blair and Momtaz, 2018; Karlsson and McLean, 2020), financing farm inputs (Guido et al., 2018)	Job and education for migrants (Marino and Lazrus, 2015)	
	Diversifying livelihoods (15.5.6)	*Limited* to *medium evidence, low agreement*	Changing fishing grounds and considering weather insurance in Antigua, Dominican Republic, and Efate (Vanuatu) (Blair and Momtaz, 2018; Karlsson and McLean, 2020) (Lemahieu et al., 2018; Turner et al., 2020)	Use of indigenous knowledge and local knowledge and changing fishing areas (Blair and Momtaz, 2018)	Yes, in both Antiqua and Vanuatu (Blair and Momtaz, 2018). New fishing areas in Vanuatu (Blair and Momtaz, 2018) and fishermen go further off-shore in Madagascar (Lemahieu et al., 2018) and Dominican Republic (Karlsson and McLean, 2020)		Diversification allows fishermen to fish in new areas and reduces pressure on previous fishing areas (benefits for biodiversity)	New technologies and moving to new areas enable greater catch which puts pressure on the fish stock
	Improved technology and equipment/ training (15.5.6)	*Limited evidence, medium agreement*	In Antigua, adaptation strategies have included investments in improved technologies and equipment, changing fishing grounds and seeking better training and education (Blair and Momtaz, 2018); in Jamaica they involved irrigation technologies due to increased drought and infrequent rainfall (Popke et al., 2016); experimenting with growing salt-tolerant (taro) crops, and relocating crop cultivation inland (McLeod et al., 2018)	Investments in improved technologies and equipment and education (Popke et al., 2016; Blair and Momtaz, 2018)	Yes, in Antiqua and Vanuatu (Blair and Momtaz, 2018) and Jamaica (Popke et al., 2016) and in Pacific Island Countries on the whole (McLeod et al., 2018).		New technologies and education strengthening (Blair and Momtaz, 2018) (Popke et al., 2016)	
	Livestock husbandry (15.5.6)	*Limited evidence*	Limited, e.g., small-scale livestock husbandry in Jamaica (Guido et al., 2018)	Varying expenditure on farm inputs and investments (Guido et al., 2018)	No evidence to date. Limited examples of successful livestock husbandry only in Jamaica (Guido et al., 2018)		Investments in farm inputs (Guido et al., 2018)	

Key risks	Risk-oriented adaptation options	Evidence and Agreement	Degree of implementation with illustrative small island examples	Key enablers	Reduces exposure and vulnerability: yes/no with illustrative examples	Overarching adaptation options supporting implementation and success	Co-benefits	Disbenefits
KR7. Economic decline and livelihood failure	**Adaptive finance/ education (15.5.6)**	*Limited evidence, medium agreement*	Limited, e.g., in Puerto Rico, women engage in new commercial enterprises (e.g., coffee shops, and food products) that do not rely on traditional coffee supply chains or government assistance (Borges-Méndez and Caron, 2019).	Tourism income provides adaptation finance, investing in education and capacity building, and working with nature rather than against it (Loehr, 2019). Public–private partnerships (Khan and Amelie, 2015). Ecosystem-based Adaptation initiatives in the Carribean (Mycoo, 2018; Loehr, 2019)	Reduces risk and avoids negative knock-on effects (Loehr, 2019).		Generates opportunities, e.g., for wetland tourism (Khan and Amelie, 2015)	
	Product/ market diversification (15.5.6)	*Medium evidence, high agreement*	Widespread, e.g., in Vanuatu and Fiji, households and communities diversify crops within gardens, garden in different areas within their customary lands and store and preserve certain foodstuffs (Campbell, 2014; McMillen et al., 2014; Guido et al., 2018; Le Dé et al., 2018). In Jamaica, there is diversifying cropping patterns and expanding or prioritising other cash crops (e.g., fruits and vegetables) (Popke et al., 2016).	Availability of different crops and land (Campbell, 2014; McMillen et al., 2014; Guido et al., 2018; Le Dé et al., 2018) and new markets (Borges-Méndez and Caron, 2019)	Reduces vulnerability to tropical cyclones in Fiji and Vanuatu (Campbell, 2014; McMillen et al., 2014; Le Dé et al., 2018) as adaptation strategy in Jamaica (Guido et al., 2018), and new markets in Puerto Rico (Borges-Méndez and Caron, 2019)		Food security and nutrition (Le Dé et al., 2018) and income security (Borges-Méndez and Caron, 2019)	
	Adaptation in tourism policies (15.5.6)	*Limited evidence, high agreement*	Limited, e.g., in the British Virgin Islands, policies like adaptation taxes and levies imposed on tourism can provide funding for adaptation measures (Smith, 2017; Mycoo, 2018a).	Implementation of tourism regulations and policies that mainstream climate change adaptations (van der Veeken et al., 2016; Mycoo, 2018a; Becken et al., 2020; Thomas and Benjamin, 2020); taxes and levies imposed on tourism (e.g., British Virgin Islands' The Environmental Protection and Tourism Improvement Fund Act, 2017 (Smith, 2017; Mycoo, 2018a).	*Limited evidence* in reducing vulnerability (Smith, 2017; Mycoo, 2018a).			

Key risks	Risk-oriented adaptation options	Evidence and Agreement	Degree of implementation with illustrative small island examples	Key enablers	Reduces exposure and vulnerability: yes/no with illustrative examples	Overarching adaptation options supporting implementation and success	Co-benefits	Disbenefits
KR8. Loss of cultural resources and heritage	**Integrating IKLK with Western science to provide integrated approaches to climate change (15.6.5)**	*Medium evidence, high agreement*	Reported in the Pacific, including in Niue, Tonga, Vanuatu and the Solomon Islands (Chand et al., 2014; Chambers et al., 2017; 2019); and in the Caribbean, e.g., suggested Caribbean Local and Traditional Knowledge Network to share information (Beckford, 2018).	Use of IKLK across islands in preparing for disasters and understanding environmental change (Chand et al., 2014; Johnston, 2015; Janif et al., 2016; Granderson, 2017; Kelman et al., 2017); social networks in sharing information and helping others (Turner, 2020); ecotheology increasing people's awareness of the environment (Rubow and Bird, 2016).	Yes, can reduce vulnerability when IKLK supports robust adaptation. No, can increase vulnerability if IKLK no longer provides accurate information.	Supporting and integrating IKLK (Blair and Momtaz, 2018; Karlsson and McLean, 2020)	Can increase climate change information and its understanding in communities, and increase culturally appropriate climate adaptation	Reports from Vanuatu indicate that IKLK are at times inaccurate (e.g., seasonal calendars, biophysical weather indicators) due to climate change (Granderson, 2017)
	Hard protection (15.5.1)	*Limited evidence, low agreement*	Widespread in protecting cultural sites and villages, e.g., Samoa (Crichton and Esteban, 2018).		Reduces exposure in some places but not in others; increases vulnerability (Nunn et al., 2021).			

References

Aladenola, O., A. Cashman and D. Brown, 2016: Impact of El Niño and Climate Change on Rainwater Harvesting in a Caribbean State. *Water Resour. Manag.*, **30**(10), 3459–3473, doi:10.1007/s11269-016-1362-2.

Alagna, A., et al., 2019: Taking advantage of seagrass recovery potential to develop novel and effective meadow rehabilitation methods. *Mar. Pollut. Bull.*, **149**, 110578, doi:10.1016/j.marpolbul.2019.110578.

Albert, S., et al., 2018: Heading for the hills: climate-driven community relocations in the Solomon Islands and Alaska provide insight for a 1.5°C future. *Reg. Environ. Change*, **18**(8), 2261–2272, doi:10.1007/s10113-017-1256-8.

Attzs, M., M. Maharaj and G. Boodhan, 2014: *Survey and Assessment of Environmental Taxes in the Caribbean*. Inter-American Development Bank, Washington DC, USA.

Bailey, R.T., et al., 2018: Sustainability of rainwater catchment systems for small island communities. *J. Hydrol.*, **557**, 137–146, doi:10.1016/j.jhydrol.2017.12.016.

Bates, A.E., et al., 2019: Climate resilience in marine protected areas and the 'Protection Paradox'. *Biol. Conserv.*, **236**, 305–314, doi:10.1016/j.biocon.2019.05.005.

Bayraktarov, E., et al., 2016: The cost and feasibility of marine coastal restoration. *Ecol. Appl.*, **26**(4), 1055–1074, doi:10.1890/15-1077.

Becken, S., E. Whittlesea, J. Loehr and D. Scott, 2020: Tourism and climate change: evaluating the extent of policy integration. *J. Sustain. Tour.*, **28**(10), 1603–1624, doi:10.1080/09669582.2020.1745217.

Beckford, C., 2018: Climate change resiliency in Caribbean SIDS: building greater synergies between science and local and traditional knowledge. *J. Environ. Stud. Sci.*, **8**(1), 42–50, doi:10.1007/s13412-017-0440-y.

Bertana, A., 2020: The role of power in community participation: Relocation as climate change adaptation in Fiji. *Environ. Plan. C Polit. Space*, **38**(5), 902–919, doi:10.1177/2399654420909394.

Betzold, C. and I. Mohamed, 2017: Seawalls as a response to coastal erosion and flooding: a case study from Grande Comore, Comoros (West Indian Ocean). *Reg. Environ. Change*, **17**(4), 1077–1087, doi:10.1007/s10113-016-1044-x.

Beyerl, K., H.A. Mieg and E. Weber, 2018: Comparing perceived effects of climate-related environmental change and adaptation strategies for the Pacific small island states of Tuvalu, Samoa, and Tonga. *Isl. Stud. J.*, **13**(1), 25–44, doi:10.24043/isj.53.

Biribo, N. and C. Woodroffe, 2013: Historical area and shoreline change of reef islands around Tarawa Atoll, Kiribati. *Sustain. Sci.*, **8**(3), 345–362, doi:10.1007/s11625-013-0210-z.

Bisaro, A., et al., 2019: Leveraging public adaptation finance through urban land reclamation: cases from Germany, the Netherlands and the Maldives. *Clim. Change*, **160**(4), 671–689, doi:10.1007/s10584-019-02507-5.

Blair, A. and S. Momtaz, 2018: Climate change perception and response: Case studies of Fishers from Antigua and Efate. *Ocean. Coast. Manag.*, **157**, 86–94, doi:10.1016/j.ocecoaman.2018.02.015.

Borges-Méndez, R. and C. Caron, 2019: Decolonizing Resilience: The Case of Reconstructing the Coffee Region of Puerto Rico After Hurricanes Irma and Maria. *J. Extrem. Events*, **06**(01), doi:10.1142/s2345737619400013.

Brown, C.J., et al., 2017: Tracing the influence of land-use change on water quality and coral reefs using a Bayesian model. *Sci. Rep.*, **7**(1), 4740, doi:10.1038/s41598-017-05031-7.

Brown, S., et al., 2020: Land raising as a solution to sea-level rise: An analysis of coastal flooding on an artificial island in the Maldives. *J. Flood Risk Manag.*, **13**(S1), doi:10.1111/jfr3.12567.

Buckwell, A., et al., 2019: Social benefit cost analysis of ecosystem-based climate change adaptations: a community-level case study in Tanna Island, Vanuatu. *Clim. Dev.*, 1–16, doi:10.1080/17565529.2019.1642179.

Campbell, J., 2014: Development, global change and traditional food security in Pacific Island countries. *Reg. Environ. Change*, **15**(7), 1313–1324, doi:10.1007/s10113-014-0697-6.

CANARI, 2020: *Rising to the climate challenge: Coastal and marine resilience in the Caribbean, Barataria, Trinidad and Tobago*. https://canari.org/wp-content/uploads/2020/08/CANARI-Coastal-Marine-Resilience-Issue-Paper.pdf.

Carlson, R.R., S.A. Foo and G.P. Asner, 2019: Land Use Impacts on Coral Reef Health: A Ridge-to-Reef Perspective. *Front. Mar. Sci.*, **6**, doi:10.3389/fmars.2019.00562.

Chambers, L., et al., 2019: Traditional or contemporary weather and climate forecasts: reaching Pacific communities. *Reg. Environ. Change*, doi:10.1007/s10113-019-01487-7.

Chambers, L., et al., 2017: A database for traditional knowledge of weather and climate in the Pacific. *Meteorol. Appl.*, **24**(3), 491–502, doi:10.1002/met.1648.

Chan, T., et al., 2020: Climate adaptation for rural water and sanitation systems in the Solomon Islands: A community scale systems model for decision support. *Sci. Total Environ.*, **714**, 136681, doi:10.1016/j.scitotenv.2020.136681.

Chand, S., et al., 2014: Indigenous Knowledge for Environmental Prediction in the Pacific Island Countries. *Weather. Clim. Soc.*, **6**(4), 445–450, doi:10.1175/wcas-d-13-00053.1.

Chong, J., 2014: Ecosystem-based approaches to climate change adaptation: progress and challenges. *Int. Environ. Agreements Polit. Law Econ.*, **14**(4), 391–405, doi:10.1007/s10784-014-9242-9.

Comeros-Raynal, M., et al., 2017: *Applying a Ridge to Reef framework to support watershed, water quality, and community-based fisheries management in American Samoa*. Agency, A. S. E. P, Pago Pago, American Samoa.

Courchamp, F., et al., 2014: Climate change, sea-level rise, and conservation: keeping island biodiversity afloat. *Trends Ecol. Evol.*, **29**(3), 127–130, doi:10.1016/j.tree.2014.01.001.

Crichton, R. and M. Esteban, 2018: Chapter 16: Limits to Coastal Adaptation in Samoa: Insights and Experiences. In: *Limits to Climate Change Adaptation*, [Filho, W.L. and J. Nalau)](eds.)]. Springer, Cham, Switzerland, pp. 283–300. ISBN 978-3319645988.

Cummings, K., A. Zuke, B. De Stasio and J. Krumholz, 2015: Coral Growth Assessment on an Established Artificial Reef in Antigua. *Ecol. Restor.*, **33**(1), 90–95, doi:10.3368/er.33.1.90.

Cvitanovic, C., et al., 2016: Linking adaptation science to action to build food secure Pacific Island communities. *Clim. Risk Manag.*, **11**, 53–62, doi:10.1016/j.crm.2016.01.003.

Daigneault, A., P. Brown and D. Gawith, 2016: Dredging versus hedging: Comparing hard infrastructure to ecosystem-based adaptation to flooding. *Ecol. Econ.*, **122**, 25–35, doi:10.1016/j.ecolecon.2015.11.023.

Delevaux, J.M.S., et al., 2018a: Scenario planning with linked land-sea models inform where forest conservation actions will promote coral reef resilience. *Sci. Rep.*, **8**(1), 12465, doi:10.1038/s41598-018-29951-0.

Delevaux, J.M.S., et al., 2018b: A linked land-sea modeling framework to inform ridge-to-reef management in high oceanic islands. *PLoS ONE*, **13**(3), e193230, doi:10.1371/journal.pone.0193230.

Dey, M., et al., 2016: Economic impact of climate change and climate change adaptation strategies for fisheries sector in Solomon Islands: Implication for food security. *Mar. Policy.*, **67**, 171–178, doi:10.1016/j.marpol.2016.01.004.

Duvat, V., 2013: Coastal protection structures in Tarawa Atoll, Republic of Kiribati. *Sustain. Sci.*, **8**(3), 363–379, doi:10.1007/s11625-013-0205-9.

Duvat, V., A. Anisimov and A. Magnan, 2020a: Assessment of coastal risk reduction and adaptation-labelled responses in Mauritius Island (Indian Ocean). *Reg. Environ. Change*, **20**(110), doi:10.1007/s10113-020-01699-2.

Duvat, V., et al., 2020b: Contribution of moderate climate events to atoll island building (Fakarava Atoll, French Polynesia). *Geomorphology*, **354**(107057), doi:10.1016/j.geomorph.2020.107057.

Duvat, V.K.E., et al., 2021: Risks to future atoll habitability from climate-driven environmental changes. *WIREs Clim. Chang.*, doi:10.1002/wcc.700.

Enríquez-de-Salamanca, Á., 2018: Vulnerability reduction and adaptation to climate change through watershed management in St. Vincent and the Grenadines. *GeoJournal*, **84**(4), 1107–1119, doi:10.1007/s10708-018-9914-z.

Esteban, M., et al., 2020: Adaptation to sea level rise: Learning from present examples of land subsidence. *Ocean. Coast. Manag.*, **189**, doi:10.1016/j.ocecoaman.2019.104852.

Fabian, R., M. Beck and D. Potts, 2013: *Reef Restoration for Coastal Defense: A Review*. University of California, Santa Cruz, USA.

GIZ, 2015: *Integrated management of transboundary watershed Rio Libon*. Deutsche Gesellschaft für Internationale Zusammenarbeit., https://www.giz.de/en/worldwide/24808.html.

Gohar, A., A. Cashman and F. Ward, 2019: Managing food and water security in Small Island States: New evidence from economic modelling of climate stressed groundwater resources. *J. Hydrol.*, **569**, 239–251, doi:10.1016/j.jhydrol.2018.12.008.

Gould, W.A., J. Castro-Prieto and N.L. Álvarez-Berríos, 2020: Climate Change and Biodiversity Conservation in the Caribbean Islands. In: *Encyclopedia of the World's Biomes*, pp. 114–125. ISBN 978-0128160978.

Goulding, W., P. Moss and C. McAlpine, 2016: Cascading effects of cyclones on the biodiversity of Southwest Pacific islands. *Biol. Conserv.*, **193**, 143–152, doi:10.1016/j.biocon.2015.11.022.

Granderson, A., 2017: The Role of Traditional Knowledge in Building Adaptive Capacity for Climate Change: Perspectives from Vanuatu. *Weather. Clim. Soc.*, **9**(3), 545–561, doi:10.1175/wcas-d-16-0094.1.

Guido, Z., et al., 2018: The stresses and dynamics of smallholder coffee systems in Jamaica's Blue Mountains: a case for the potential role of climate services. *Clim. Change*, **147**(1-2), 253–266, doi:10.1007/s10584-017-2125-7.

Ha'apio, M.O., R. Gonzalez and M. Wairiu, 2019: Is there any chance for the poor to cope with extreme environmental events? Two case studies in the Solomon Islands. *World Dev.*, **122**, 514–524, doi:10.1016/j.worlddev.2019.06.023.

Hagedoorn, L., et al., 2019: Community-based adaptation to climate change in small island developing states: an analysis of the role of social capital. *Clim. Dev.*, 1–12, doi:10.1080/17565529.2018.1562869.

Hidalgo, D., et al., 2021: Climate change adaptation planning in remote contexts: insights from community-based natural resource management and rural development initiatives in the Pacific Islands. *Clim. Dev.*, 1–13, doi:10.1080/17565529.2020.1867046.

Hills, T., T.J.B. Carruthers, S. Chape and P. Donohoe, 2013: A social and ecological imperative for ecosystem-based adaptation to climate change in the Pacific Islands. *Sustain. Sci.*, **8**(3), 455–467, doi:10.1007/s11625-013-0217-5.

Hinkel, J., et al., 2018: The ability of societies to adapt to twenty-first-century sea-level rise. *Nat. Clim. Change*, **8**(7), 570–578, doi:10.1038/s41558-018-0176-z.

Jackson, C., D. Bush and W. Neal, 2012: Documenting beach loss in front of seawalls in Puerto Rico: pitfalls of engineering a small Island nation shore. In: *Pitfalls of Shoreline Stabilization* [Cooper, J.A.G. and O.H. Pilkey)](eds.)]. Springer, Netherlands.

Jamero, M.L., et al., 2017: Small-island communities in the Philippines prefer local measures to relocation in response to sea-level rise. *Nat. Clim. Change*, **7**(8), 581–586, doi:10.1038/nclimate3344.

Janif, S., et al., 2016: Value of traditional oral narratives in building climate-change resilience: insights from rural communities in Fiji. *Ecol. Soc.*, **21**(2), doi:10.5751/ ES-08100-210207.

Johnston, I., 2015: Traditional warning signs of cyclones on remote islands in Fiji and Tonga. *Environ. Hazards*, **14**(3), 210–223, doi:10.1080/17477891.2015.1046156.

Jones, H., et al., 2016: Invasive mammal eradication on islands results in substantial conservation gains. *PNAS*, **113**(15), 4033–4038, doi:10.1073/pnas.1521179113.

Jupiter, S.D., et al., 2014: Principles for integrated island management in the tropical Pacific. *Pac. Conserv. Biol.*, **20**(2), doi:10.1071/pc140193.

Karlsson, M. and E. McLean, 2020: Caribbean Small-Scale Fishers' Strategies for Extreme Weather Events: Lessons for Adaptive Capacity from the Dominican Republic and Belize. *Coast. Manag.*, **48**(5), 456–480, doi:10.1080/08920753.2020.1795971.

Kelman, I., et al., 2017: Here and now: perceptions of Indian Ocean islanders on the climate change and migration nexus. *Geogr. Ann. Ser. B Hum. Geogr.*, **99**(3), 284–303, doi:10.1080/04353684.2017.1353888.

Kench, P., 2012: Compromising Reef Island Shoreline Dynamics: Legacies of the Engineering Paradigm in the Maldives. In: *Pitfalls of Shoreline Stabilization: Selected Case Studies* [Cooper, J. and O. Pilkey(eds.)]. Springer, Cham, Switzerland, pp. 165–186. ISBN 978-9400741225.

Keppel, G., C. Morrison, J. Meyer and H. Boehmer, 2014: Isolated and vulnerable: the history and future of Pacific Island terrestrial biodiversity. *Pac. Conserv. Biol.*, **20**(2).

Khan, A. and V. Amelie, 2015: Assessing climate change readiness in Seychelles: implications for ecosystem-based adaptation mainstreaming and marine spatial planning. *Reg. Environ. Change*, **15**(4), 721–733, doi:10.1007/s10113-014-0662-4.

Klöck, C. and M. Finch, 2019: Dealing with Climate Change on Small Islands: Towards Effective and Sustainable Adaptation? In: *Dealing with climate change on small islands: Towards effective and sustainable adaptation*, pp. 1–15. ISBN 978-3863954352.

Le Cornu, E., et al., 2018: Spatial management in small-scale fisheries: A potential approach for climate change adaptation in Pacific Islands. *Mar. Policy.*, **88**, 350–358, doi:10.1016/j.marpol.2017.09.030.

Le Dé, L., T. Rey, F. Leone and D. Gilbert, 2018: Sustainable livelihoods and effectiveness of disaster responses: a case study of tropical cyclone Pam in Vanuatu. *Nat. Hazards*, **91**(3), 1203–1221, doi:10.1007/s11069-018-3174-6.

Lemahieu, A., et al., 2018: Local perceptions of environmental changes in fishing communities of southwest Madagascar. *Ocean. Coast. Manag.*, **163**, 209–221, doi:10.1016/j.ocecoaman.2018.06.012.

Loehr, J., 2019: The Vanuatu Tourism Adaptation System: a holistic approach to reducing climate risk. *J. Sustain. Tour.*, **28**(4), 515–534, doi:10.1080/09669582.2019.1683185.

Luke, S.H., et al., 2017: The effects of catchment and riparian forest quality on stream environmental conditions across a tropical rainforest and oil palm landscape in Malaysian Borneo. *Ecohydrology*, **10**(4), e1827, doi:10.1002/eco.1827.

Magnan, A. and V. Duvat, 2018: Unavoidable solutions for coastal adaptation in Reunion Island (Indian Ocean). *Environ. Sci. Policy*, **89**, 393–400, doi:10.1016/j.envsci.2018.09.002.

Magnan, A., et al., 2018: Atoll population exposure to marine inundation: the example of the Tuamotu Archipelago (Rangiroa and Tikehau atolls), French Polynesia. *VertigO*, **18**(3), doi:10.4000/vertigo.23607.

Maharaj, S., et al., 2019: Assessing protected area effectiveness within the Caribbean under changing climate conditions: A case study of the small island, Trinidad. *Land Use Policy*, **81**, 185–193, doi:10.1016/j.landusepol.2018.09.030.

Marino, E. and H. Lazrus, 2015: Migration or Forced Displacement?: The Complex Choices of Climate Change and Disaster Migrants in Shishmaref, Alaska and Nanumea, Tuvalu. *Hum. Organ.*, **74**(4), 341–350, doi:10.17730/0018-7259-74.4.341.

McCubbin, S., B. Smit and T. Pearce, 2015: Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. *Glob. Environ. Chang.*, **30**, 43–55, doi:10.1016/j.gloenvcha.2014.10.007.

McIver, L., et al., 2014: Assessment of the health impacts of climate change in Kiribati. *Int. J. Environ. Res. Public Health*, **11**(5), 5224–5240, doi:10.3390/ijerph110505224.

McLeod, E., et al., 2018: Raising the voices of Pacific Island women to inform climate adaptation policies. *Mar. Policy*, **93**, 178–185, doi:10.1016/j.marpol.2018.03.011.

McLeod, E., et al., 2019: Lessons From the Pacific Islands – Adapting to Climate Change by Supporting Social and Ecological Resilience. *Front. Mar. Sci.*, **6**, doi:10.3389/fmars.2019.00289.

McMillen, H., T. Ticktin and H.K. Springer, 2016: The future is behind us: traditional ecological knowledge and resilience over time on Hawaii Island. *Reg. Environ. Change*, **17**(2), 579–592, doi:10.1007/s10113-016-1032-1.

McMillen, H.L., et al., 2014: Small islands, valuable insights: systems of customary resource use and resilience to climate change in the Pacific. *Ecol. Soc.*, **19**(4), doi:10.5751/es-06937-190444.

McNamara, K. and D. Combes, 2015: Planning for Community Relocations Due to Climate Change in Fiji. *Int. J. Dis. Risk Sci.*, **6**(3), 315–319, doi:10.1007/s13753-015-0065-2.

McNamara, K.E., et al., 2020: An assessment of community-based adaptation initiatives in the Pacific Islands. *Nat. Clim. Change*, **10**(7), 628–639, doi:10.1038/s41558-020-0813-1.

Mercer, J., I. Kelman, B. Alfthan and T. Kurvits, 2012: Ecosystem-Based Adaptation to Climate Change in Caribbean Small Island Developing States: Integrating Local and External Knowledge. *Sustainability*, **4**(8), 1908–1932, doi:10.3390/su4081908.

Mercer, J., et al., 2014: Nation-building policies in Timor-Leste: disaster risk reduction, including climate change adaptation. *Disasters*, **38**(4), 690–718, doi:10.1111/disa.12082.

Monahan, W.B. and D.M. Theobald, 2018: Climate change adaptation benefits of potential conservation partnerships. *PLoS ONE*, **13**(2), e191468, doi:10.1371/journal.pone.0191468.

Monty, F., R. Murti and N. Furuta, 2016: *Helping nature help us: Transforming disaster risk reductionthrough ecosystem management*. IUCN, Gland, Switzerland. 82 pp.

Mouillot, D., et al., 2020: Global correlates of terrestrial and marine coverage by protected areas on islands. *Nat. Commun.*, **11**(1), 4438, doi:10.1038/s41467-020-18293-z.

Mycoo, M., 2014: Autonomous household responses and urban governance capacity building for climate change adaptation: Georgetown, Guyana. *Urban. Clim.*, **9**, 134–154, doi:10.1016/j.uclim.2014.07.009.

Mycoo, M. and M. Donovan, 2017: *A Blue Urban Agenda: Adapting to Cliamte Change in the Coastal Cities of Caribbean and Pacific Small Island Developing States*. IBD, Washington, D.C., ISBN 978-1597822931.

Mycoo, M., 2018a: Beyond 1.5°C: vulnerabilities and adaptation strategies for Caribbean Small Island Developing States. *Reg. Environ. Change*, **18**(8), 2341–2353, doi:10.1007/s10113-017-1248-8.

Mycoo, M. A., 2018b: Achieving SDG 6: water resources sustainability in Caribbean Small Island Developing States through improved water governance. *Nat. Resour Forum*, **42**(1), 54–68, doi:10.1111/1477-8947.12141.

Nalau, J., et al., 2018: The Role of Indigenous and Traditional Knowledge in Ecosystem-Based Adaptation: A Review of the Literature and Case Studies from the Pacific Islands. *Weather. Clim. Soc.*, **10**(4), 851–865, doi:10.1175/wcas-d-18-0032.1.

Nanni, A.S., et al., 2019: The neotropical reforestation hotspots: A biophysical and socioeconomic typology of contemporary forest expansion. *Glob. Environ. Chang.*, **54**, 148–159, doi:10.1016/j.gloenvcha.2018.12.001.

Naylor, A., 2015: Island morphology, reef resources, and development paths in the Maldives. *Prog. Phys. Geogr.*, **39**(6), 728–749, doi:10.1177/0309133315598269.

Nunn, P. and R. Kumar, 2018: Understanding climate-human interactions in Small Island Developing States (SIDS). *Int. J. Clim. Chang. Strateg. Manag.*, **10**(2), 245–271, doi:10.1108/ijccsm-01-2017-0012.

Nunn, P.D., C. Klöck and V. Duvat, 2021: Seawalls as maladaptations along island coasts. *Ocean. Coast. Manag.*, **205**, doi:10.1016/j.ocecoaman.2021.105554.

Onaka, S., H. Hashimoto, N. B. Soogun and A. Jheengut, 2015: Coastal Erosion and Demonstration Project as Coastal Adaptation Measures in Mauritius. In: *Handbook of Coastal Disaster Mitigation for Engineers and Planners*, pp. 561–577. ISBN 978-0128010600.

Onaka, S., et al., 2017: Effectiveness of Gravel Beach Nourishment on Pacific Island. *Asian Pac. Coastas*, 651–662, doi:10.1142/9789813233812_0059.

Parnell, K.E. and S.G. Smithers, 2020: Regional and Local Variability in Coastal Processes in Torres Strait, Australia, and its Importance for Climate Change Planning. *J. Coast. Res.*, **95**(sp1), doi:10.2112/si95-120.1.

Peters, E.J., 2019: Desalination for augmenting domestic rainwater harvesting in the Grenadines. *Proc. Inst. Civ. Eng. Water Manag.*, **172**(4), 195–206, doi:10.1680/jwama.16.00097.

Petzold, J., B. Ratter and A. Holdschlag, 2018: Competing knowledge systems and adaptability to sea-level rise in The Bahamas. *Area*, **50**(1), 91–100, doi:10.1111/area.12355.

Piggott-McKellar, A., K. McNamara, P. Nunn and S. Sekinini, 2019: Moving People in a Changing Climate: Lessons from Two Case Studies in Fiji. *Soc. Sci.*, **8**(133), doi:10.3390/socsci8050133.

Pinnegar, J., et al., 2019: Assessing vulnberability and adaptive capacity of the fisheries sector in Dominica: long-term climate change and catastrophic hurricanes. *ICES J. Mar. Sci.*, **76**(5), 1353–1367, doi:10.1093/icesjms/fsz052.

Popke, J., S. Curtis and D. Gamble, 2016: A social justice framing of climate change discourse and policy: Adaptation, resilience and vulnerability in a Jamaican agricultural landscape. *Geoforum*, **73**, 70–80, doi:10.1016/j.geoforum.2014.11.003.

Quigley, N., S. Beavis and I. White, 2016: Rainwater harvesting augmentation of domestic water supply in Honiara, Solomon Islands. *Aust. J. Water Resour.*, **20**(1), 65–77, doi:10.1080/13241583.2016.1173314.

Rasheed, S., S.C. Warder, Y. Plancherel and M.D. Piggott, 2020: Response to tidal flow regime and sediment transportation in North Male' Atoll, Maldives to coastal modification and sea level rise. *Ocean. Sci.*, doi:10.5194/os-2020-80.

Ratter, B.M.W., A. Hennig and A. Zahid, 2019: Challenges for shared responsibility - Political and social framing of coastal protection transformation in the Maldives. *Erde*, **150**(3), 169–183, doi:10.12854/erde-2019-426.

Remling, E. and J. Veitayaki, 2016: Community-based action in Fiji's Gau Island: a model for the Pacific? *Int. J. Clim. Chang. Strateg. Manag.*, **8**(3), 375–398, doi:10.1108/ijccsm-07-2015-0101.

Robinson, S., 2017: Mainstreaming climate change adaptation in small island developing states. *Clim. Dev.*, **11**(1), 47–59, doi:10.1080/17565529.2017.1410086.

Romine, B. and C. Fletcher, 2013: A Summary of Historical Shoreline Changes on Beaches of Kauai, Oahu, and Maui, Hawaii. *J. Coast. Res.*, **288**, 605–614, doi:10.2112/jcoastres-d-11-00202.1.

Rubow, C. and C. Bird, 2016: Eco-theological Responses to Climate Change in Oceania. *Worldviews*, **20**(2), 150–168, doi:10.1163/15685357-02002003.

Rude, J., et al., 2016: Ridge to reef modelling for use within land-sea planning under data-limited conditions. *Aquat. Conserv. Mar. Freshw. Ecosyst.*, **26**(2), 251–264, doi:10.1002/aqc.2548.

Sainsbury, N.C., et al., 2019: The challenges of extending climate risk insurance to fisheries. *Nat. Clim. Chang.*, **9**(12), 896–897, doi:10.1038/s41558-019-0645-z.

Schleicher, J., C.A. Peres and N. Leader-Williams, 2019: Conservation performance of tropical protected areas: How important is management? *Conserv. Lett.*, **12**(5), doi:10.1111/conl.12650.

Schnitter, R., et al., 2019: An Assessment of Climate Change and Health Vulnerability and Adaptation in Dominica. *Int. J. Environ.Res. Public Health*, **16**(1), doi:10.3390/ijerph16010070.

Scobie, M., 2016: Policy coherence in climate governance in Caribbean small island developing states. *Environ. Sci. Policy*, **58**, 16–28, doi:10.1016/j.envsci.2015.12.008.

Scriven, S.A., J.A. Hodgson, C.J. McClean and J.K. Hill, 2015: Protected areas in Borneo may fail to conserve tropical forest biodiversity under climate change. *Biol. Conserv.*, **184**, 414–423, doi:10.1016/j.biocon.2015.02.018.

Shaig, A., 2011: *Survey of Climate Change Adaptation Measure in Maldives* Ministry of Housing and Environment and United Nationals Development Programme, Maldives.

Shakeela, A. and S. Becken, 2015: Understanding tourism leaders' perceptions of risks from climate change: an assessment of policy-making processes in the Maldives using the social amplification of risk framework (SARF). *J. Sustain. Tour.*, **23**(1), 65–84, doi:10.1080/09669582.2014.918135.

Silva-Rocha, I., et al., 2015: Snakes on the Balearic islands: an invasion tale with implications for native biodiversity conservation. *PLoS ONE*, **10**(4), e121026, doi:10.1371/journal.pone.0121026.

Smith, S., *Environmental Levy Takes Effect September 1*. Government of the British Virgin Islands, British Virgin Islands, https://www.bvitourism.com/news/environmental-levy-takes-effect-september-1.

SPCR, 2011: *Jamaica Strategic Programme for Climate Resilience*.

Tabe, T., 2019: Climate Change Migration and Displacement: Learning from Past Relocations in the Pacific. *Soc. Sci.*, **8**(218), doi:10.3390/socsci8070218.

Temmerman, S., et al., 2013: Ecosystem-based coastal defence in the face of global change. *Nature*, **504**(7478), 79–83, doi:10.1038/nature12859.

Thomas, A. and L. Benjamin, 2020: Chapter 12: Climate change, tourism and sustainable development in the Bahamas. In: *Tourism Development, Governance, and Sustainability in the Bahamas* [Rolle, S., J. Minnis and I. Bethell-Bennett(eds.)]. Taylor and Francis Group, London, UK.

Thomas, L.R., T. Clavelle, D.H. Klinger and S.E. Lester, 2019: The ecological and economic potential for offshore mariculture in the Caribbean. *Nat. Sustain.*, **2**(1), 62–70, doi:10.1038/s41893-018-0205-y.

Tomlinson, J. and K. Rhiney, 2017: Assessing the role of farmer field schools in promoting pro-adaptive behaviour towards climate change among Jamaican farmers. *J. Environ. Stud. Sci.*, **8**(1), 86–98, doi:10.1007/s13412-017-0461-6.

Turner, R., P. McConney and I. Monnereau, 2020: Climate Change Adaptation and Extreme Weather in the Small-Scale Fisheries of Dominica. *Coast. Manag.*, **48**(5), 436–455, doi:10.1080/08920753.2020.1795970.

UNDP, *Increasing community adaptation and ecosystem resilience to climate change in Portland Bight (CCAM)*. Community-Based Adaptation, Jamaica.

van der Veeken, S., et al., 2016: Tourism destinations' vulnerability to climate change: Nature-based tourism in Vava'u, the Kingdom of Tonga. *Tour. Hosp. Res.*, **16**(1), 50–71, doi:10.1177/1467358415611068.

Veitayaki, J. and E. Holland, 2017: *Lessons from Lomani Gau Project, Fiji: A Local Community's Response to Climate Change*, 121–138.

Voccia, A., 2011: Climate change: what future for small, vulnerable states? *Int. J. Sustain. Dev. World Ecol.*, **19**(2), 101–115, doi:10.1080/13504509.2011.634032.

Vorsino, A.E., et al., 2014: Modeling Hawaiian ecosystem degradation due to invasive plants under current and future climates. *PLoS One*, **9**(5), e95427, doi:10.1371/journal.pone.0095427.

Wang, C., M. Yu and Q. Gao, 2017: Continued Reforestation and Urban Expansion in the New Century of a Tropical Island in the Caribbean. *Remote Sens.*, **9**(7), doi:10.3390/rs9070731.

Weber, E., 2016: Only a pawn in their games? Environmental (?) migration in Kiribati – past, present and future. *Erde*, **147**(2), 153–164, doi:10.12854/erde-147-11.

Williams, D., S. Rosendo, O. Sadasing and L. Celliers, 2020: Identifying local governance capacity needs for implementing climate change adaptation in Mauritius. *Clim. Policy*, **20**(5), 548–562, doi:10.1080/14693062.2020.1745743.