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Emerging Issues for Small Island Developing States

Results of the UNEP Foresight Process

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Audrey Ringler (DEWA, UNEP)

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Acknowledgements

UNEP Coordination Team: Joana Akrofi; Sunday A. Leonard; Jacqueline McGlade; Takehiro Nakamura.

UNEP SIDS Foresight Panel: Asma Ali Abahussain (Arabian Gulf University, Manama, Bahrain); John Agard (University of the West Indies, Trinidad and Tobago); Garfield Barnwell (Caribbean Community (CARICOM) Secretariat, Georgetown, Guyana); Soobasschandra Chacowry (Association pour le Developpemnt Durable, Le Hochet, Mauritius); Arthur Dahl (International Environment Forum); Imogen P. Ingram (Island Sustainability Alliance CIS Inc. Rarotonga, Cook Islands); Leonard Nurse (University of West Indice, Barbados), Randolph Thaman (University of the South Pacific, Suva, Fiji); John Roberts (Indian Ocean Commission, Mauritius); David Sheppard (Secretariat of the Pacific Regional Environment Programme, Apia, Samoa); Asha Singh (Organization of Eastern Caribbean States, Morne, Castries, St. Lucia).

UN DESA SIDS Foresight Panel: Byron Blake (CARICOM Secretariat); Jessica Byron (University of the West Indies); Liam Campling (Queen Mary, University of London); Ameenah Gurib-Fakim (University of Mauritius); Khalissa Iklhef (UNESCO); Joshua Jelly-Schapiro (University of California, Berkeley); Denny Lewis-Bynoe (Commonwealth Secretariat); H. E. Dr. Rolph Antoine Payet (Minister of Environment and Energy of Seychelles); Biman Prasad (Palau Resource Institute/Palau Orakiruu Corporation); Faustina Rehuher-Marugg (Palau Resource Institute/Palau Orakiruu Corporation); Katerina Teaiwa (Australian National University); Caroline Yeoh (Singapore Management University).

UNEP Foresight Panel Facilitator: Marc Gramberger (Prospex bvba).

Drafting and Editing: Sherry Heileman (Science Writer; Independent Consultant); Deborah Kirby (UNEP Consultant); Sunday A. Leonard (UNEP).

Contributors to Text: Asma Abahussain; John Agard; Joana Akrofi; Garfield Barnwell; Subash Chacowry; Arthur Dahl; Sherry Heileman (Science Writer); Imogen Ingram; Sunday A. Leonard; Randolph Thaman; Leonard Nurse; John Roberts; Asha Singh; David Shepherd.

Scientific and Expert Review: Matthew Billot (UNEP); Virginia Burkett (U.S. Geological Survey); Lino Briguglio (University of Malta Institute for Islands and Small State Sustainability); David Bynoe (Global Environmental Facility, Barbados); Adrian Cashman (University of the West Indies); Christopher Corbin (UNEP); Charles Davies (UNEP); Marion Glaser (Leibniz Center for Tropical Marine Ecology-ZMT); Stefan Gössling (Lund University); Peter King (Institute for Global Environmental Strategies); Hartwig Kremer (UNEP); Robin Mahon (University of the West Indies –Centre for Resource Management and Environmental Studies); Liana McManus (UNEP- GEF/TWAP); Theuri Mwangi (UNEP); Janak Patak (UNEP); Beate M.W. Ratter (University of Hamburg); Sachooda Ragoonaden (Association pour le Développement Durable); Pinya Sarasas (UNEP); Asha Sitati (UNEP); Elaine Stratford (University of Tasmania); Joeli Veitayaki (University of the South Pacific); Mick Wilson (UNEP); Zinta Zommers (UNEP).

Coordination of Electronic Consultation: Joana Akrofi (UNEP); Sunday A. Leonard (UNEP); Erick Litswa (UNEP).

Respondents to the Electronic Consultation: Yannick Beaudoin (GRID-Arendal); Ronald Berkeley (Permanent Secretary, Ministry of Natural Resources and Labour, Government of the British Virgin Islands); Derrick Binns (Ministry of Environment and Planning, Government of Bermuda); Byron Blake (Private- Jamaica); John Bothwell (Cayman Islands, Department of Environment); Kate Brown (Global Island Partnership); Maria Deotina Carvalho (MIREX, Cape Verde); Adrian Cashman (CERMES, University of the West Indies); Donato Cassell (External Affairs, Office of the Premier, MS); Emil Cherrington (L'Institut de recherche pour le développement); Christopher Corbin (UNEP); Jennifer Cruickshank- Howard (Fisheries Division, Saint Vincent and the Grenadines); Tara Dasgupta (Pesticide Research Laboratory, University of the West Indies); Crispin E. d'Auvergne (Sustainable Development & Environment Office, Saint Lucia); Margo Deiye (Permanent Mission of Nauru, United Nations); Félix Cristóbal Diaz Morejón (Ministry of Science, Technology and the Environment, Cuba); Caroline Eugene (Ministry of Sustainable Development, Energy, Science and Technology, Saint Lucia); Niualuga Evaimalo (Ministry of Natural Resources and Environment, Samoa); Santos Carlos Ferreira (National Institute for Fisheries Development, Cape Verde); Armindo Gonzaga (SIDS Desk, Ministry of Foreign Affairs, Communities and Cooperation of São Tome and Principe); May Una Gordon (Inter American institute for Cooperation on Agriculture); Paul Hinds (UWI St. Augustine, COSTAATT); Philmore James (Fisheries Division, Antigua and Barbuda); Flavien Joubert (Wildlife, Enforcement and Permits Division, Ministry of Environment and Energy, Seychelles); Aboud Jumbe (Department Of Environment, The First Vice President's Office, Zanzibar, The United Republic of Tanzania); Louisa Heimata Karika (National Environment Service, Cook Islands); Peter Kouwenhoven (CLIMsystems); Sébastien Larrue (University of Blaise Pascal, Clermont-Ferrand II); Robin Mahon (CERMES, UWI); Elizabeth Mclean (University of Rhode Island); Claire Nelson (Institute of Caribbean Studies/The Futures Forum); Keith Nichols (Caribbean Community Climate Change Centre); Fabian Nimea (Alliance of Small Islands Developing States); Wiezsman Pat (Sustainable Development, Ministry of Forestry, Fisheries and Sustainable Development, Belize); Andrew Prakash (Ministry of Development Planning and Aid Coordination, Solomon Islands); Cristelle Pratt (Sustainable Island Innovations, Suva, FIJI); Mack Farran Redfern (Environment and Conservation Division, Kiribati); Eric Salamanca (Department of Environment and Maritime Affairs, Turks and Caicos Islands); Ioana Lynn Seleni-Malolua (Ministry of Finance, Samoa); Umiich Sengebau (Ministry Natural Resources, Environment and Tourism, Republic of Palau); Marina Silva (Project for Consolidation of Protected Areas System, Cape Verde); Alfred Simpson (Australia); Anand Sookun (University of Mauritius); Cletus Springer (Organization of American States); Simon Springett (UNDP Mauritius/Seychelles); Tepa Suaesi (Secretariat of the Pacific Regional Environment Programme); Vincent Sweeney UNEP); Walter Talma (COMESA); Durshini Priya Thaunoo-Chadee (Ministry of Environment and Sustainable Development, Mauritius); Kimone Thompson (Jamaica Observer Ltd); Jason Williams (Environment Division, Ministry of Agriculture, Lands, Housing and the Environment, Antigua and Barbuda); Douglas William Wilson (Caribbean Wind, LLC/ IOCARIBE-GOOS); Poh Poh Wong (School of Social Sciences, University of Adelaide); Akapito Anamaria Yomai (Department of Health and Social Affairs, Federated States of Micronesia).

Production Team and UNEP Secretariat Support: Harsha Dave; Pouran Ghaffarpour; Virginia Gitari; Salome Marima; Eugene Papa; Neeyati Patel; Noami Poulton; Audrey Ringler; Shereen Zorba.

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Foreword

The sustainable development of Small Island Developing States (SIDS) is threatened by new and emerging environmental issues. Policy-makers can forge pathways to sustainable economic growth by recognising the intimate inter-linkages between social, economic and environmental challenges and by identifying the many opportunities SIDS can harness to facilitate their transition to an inclusive and green economy.

Many of the environmental and socio-economic challenges that we face today can be traced back to policy decisions of the past. This is particularly true for SIDS, which contribute little to climate change—emitting less than one per cent of global emissions—but suffer disproportionately from its effects.

SIDS have access to natural assets and unique indigenous knowledge that can help them to develop sustainably and manage their natural environment productively and equitably. In order to take advantage of these opportunities policy-makers must develop integrated solutions to environmental challenges.

This insightful and practical report, compiled in consultation with over 70 SIDS experts and scientists, provides an overview of 20 issues critical to the sustainable development of SIDS. The findings reveal that SIDS are faced with several serious environmental challenges, notably those related to climate change, including sea level rise and biodiversity damage and loss.

The report also describes the wealth of opportunities SIDS can avail of, to transition to a green economy. For example, SIDS possess unexploited natural resources in terrestrial areas as well as in their Exclusive Economic Zones (EEZs) and in the deep sea. Among these are minerals, potential pharmaceutical products, hydrocarbons, renewable energy resources, and fish stocks. Some countries are already expanding into these new areas, as seen in Papua New Guinea, which has embarked on exploratory activities for mining of seabed manganese nodules and rare earth elements.

In addition, SIDS have bountiful supplies of renewable energy sources such as biomass, wind, sun, ocean, wave, and hydro and geothermal. Accelerated deployment of renewable energy, prompted through appropriate policy interventions and public-private partnerships, offers an opportunity to widen access to sustainable energy and reduce the crippling costs of power. Barbados is already a leader in this field, with its Solar Water Heater Programme, for instance, which has netted the state between US$ 133.5 million and US$ 137 million in energy savings since it was first launched in the 1970s.

This report clearly demonstrates that SIDS have the potential to take a lead in defining holistic models of sustainability and human well-being. The international community is called upon to support SIDS as they combat the effects of climate change and forge new pathways to sustainable and inclusive economic growth.

As we look to the Third International Conference on SIDS in Samoa and beyond, I believe that the findings of the UNEP SIDS Foresight Process will provide valuable insights and evidence relevant for environmental policy-making and priority setting for SIDS. I am also confident that it will aid the wider international community to prepare intelligent, decisive and forward-looking responses to the sustainable development challenges and opportunities faced by all states, large and small.

Achim Steiner
United Nations Under-Secretary-General, and
Executive Director United Nations Environment Programme

Executive Summary

The 2012 UNEP Foresight Process on Emerging Global Environmental Issues primarily identified emerging environmental issues and possible solutions on a global scale and perspective. In 2013, UNEP carried out a similar exercise to identify priority emerging environmental issues that are of concern to the Small Island Developing States (SIDS).

For the purposes of the UNEP SIDS Foresight Process, an emerging environmental issue is defined as any **positive** or **negative** issue that is:

- critical to achieving sustainable development in the SIDS;
- related to any of the three dimensions of sustainable development—environment, social and economic—but should have particular relevance to the environment dimension;
- recognized as *very important* by the SIDS, but has not yet received *adequate attention* from the policy community. The definitions of *very important* and *adequate attention* are left open to participants in the foresight exercise;
- evidence-based, including scientific and traditional sources of knowledge;
- recognized as 'emerging' based on newness, which can be as a result of new knowledge; new scales or accelerated rates of impact; or a heightened level of awareness.

At the core of the process was a SIDS Foresight Panel consisting of 11 SIDS experts from the three SIDS regions, representing the global SIDS community and a wide range of disciplines. The process was designed to open the discussion on emerging environmental issues to a wide range of views both from the Foresight Panel and a wider community of relevant experts from across the globe.

The process included the following steps:

- *Canvass of ideas on emerging environmental issues* from the Foresight Panel, the UNEP community and other SIDS experts to identify a preliminary list of issues.
- *Foresight Panel workshop* in which Panel members debated the list of issues in a structured and systematic process. Some issues were combined and redefined, resulting in the selection of 22 priority issues.
- *Electronic consultation* in which feedback from 54 experts was received on the importance of the 22 issues to the sustainable development of SIDS.
- *First draft of report and peer review*: The UNEP Secretariat prepared a report with the issues, which was then subjected to internal and external review including by the Foresight Panel, UNEP community and SIDS Community of Practice.
- *Final report*: Based on the review comments, which agrees with those from the electronic consultation, some issues were further merged, resulting in a final list of 20 issues. The report was then finalized incorporating reviewers' comments.

The Issues

While the issues identified relate to different environmental themes, they also include issues that are cross cutting in nature, and should be viewed in a holistic and integrative manner. This report presents the outcome of the Foresight exercise and is one of UNEP's contributions to the Third International SIDS Conference to take place in Samoa in September 2014. The content of the report aligns with one of the four thematic foci of the conference: "identify new and emerging challenges and opportunities for the sustainable development of SIDS and ways and means to address them". A summary description of the issues is provided below according to the different themes with no particular order of priority.

Cross-cutting Issues

001. Beyond GDP: Developing Appropriate Indicators of SIDS Sustainable Development. Current method of measuring economic, that is the Gross Domestic Product (GDP), do not adequately capture the unique features of SIDS that are relevant to their sustainability. This causes SIDS to be misclassified in terms of their real socio-economic development and subsequent marginalization, and places them at risk of losing their cultural, environmental, and socio-economic integrity. However, the current global effort to develop new indicators 'beyond GDP' presents SIDS with an opportunity to collaborate in developing indicators that reflect their realities, aspirations, and sustainable development goals. SIDS can take the lead in defining holistic models of sustainability and human well-being that can be promoted globally. Such effort calls for credible data, relevant research, use of indigenous and local knowledge, and a participatory approach.

002. Unique Human Capacities for Island Sustainability. Global environmental change and the aspiration of SIDS to transition to a blue-green economy require new and specialized skill types, which are limited in SIDS. Building capacities for island sustainability must consider the unique characteristics of SIDS along with the development pathways of individual countries. This cannot be met by scaling down educational approaches and professional competences as it is in many larger societies. Solutions must consider local opportunities and limitations, sharing of expertise, modern information technologies, education systems that will not erode island values and sustainability, combining modern science with local and traditional knowledge, and strengthening the capacities of young people.

003. Synergizing Indigenous and Local Knowledge and Modern Science as a basis for Sustainable Island Development. SIDS possess a wealth of hitherto underutilized Indigenous and Local Knowledge (ILK) that could be synergized with modern science to develop sustainability strategies that are more appropriate to local realities. Externally derived strategies may not be appropriate to small islands, and there is need to reorient development aspirations away from conventional development. Innovative approaches and tools that are adapted to local conditions, cultures, and needs are required. This can be facilitated by harnessing and integrating ILK with modern science. Hence, there is a need to identify opportunities and mechanisms for promoting, integrating, and preserving LTK and incorporating it into the educational syllabus at all levels.

Rehabilitating Biodiversity and Ecosystem Services

004. The Continued Threat of Invasive Alien Species. Invasive alien species (IAS) are a serious yet under-acknowledged threat to sustainable development in SIDS, especially given the particularly high vulnerability and limited capacity to manage IAS. But small islands present unique opportunities for the management of IAS. Apart from obvious solutions such as restoration of native species and prevention of new introductions and eradication, SIDS can greatly benefit from coordinated action and investment at the regional level. Elevating the profile of IAS as an economic and political issue in SIDS, acquiring knowledge, raising awareness, and building capacity are also needed.

005. Averting the Loss of Tropical Montane Cloud Forests. Some SIDS have extensive areas of tropical montane cloud forests (TMCFs), which are among the world's most threatened and neglected ecosystems. Degradation of TMCFs from human activities and rising temperatures can result in the loss of important ecosystem services such as their capacity to extract moisture from clouds and release it into the hydrologic system. Their loss can have serious consequences for freshwater resources, food security, and biodiversity in SIDS. Measures to address this issue include integrated water and forest management. Relevant data and information, vulnerability risk assessments of TMCFs, and building their resilience to climate change by addressing human pressures are also needed.

006. Breakdown of Sand and Sediment Budget due to Biodiversity Loss. Many islands are composed mainly of biogenic sand and sediment that originate from the skeletal remains of calcareous marine organisms such as some corals and sponges. Declining diversity and abundance of these organisms from multiple pressures including rising water temperature, ocean acidification, and anthropogenic activities is disrupting the biogenic sand and sediment budget leading to the loss of beaches and other coastal areas. This has potentially serious environmental and socio-economic consequences in SIDS. Solutions include reducing human impacts on marine ecosystems and increasing their resilience to climate change, and minimizing the loss of coastal areas from erosion and sand mining.

007. Decline of Agrobiodiversity and Ecosystem Functions Affecting Food and Livelihood Security. Biodiversity, including agrobiodiversity, and ecosystem functions play a critical role in food production. However, the breakdown of traditional agro-ecosystems and loss of associated biodiversity and ecosystem functions from a combination of natural and anthropogenic pressures is one of the most rapidly emerging threats to food and livelihood security in SIDS. Yet, this issue is not adequately addressed. Responses include protection and restoration of agro-biodiversity through strategies such as integrated nutrient management, integrated pest management, agroforestry practices, integrated livestock management, implementing a landscape approach as well as greater utilization of available genetic resources. Addressing the food security-ecosystem nexus presents an opportunity for transitioning to a green economy that takes into consideration the conditions and sustainable development priorities of individual SIDS.

008. Overfishing and Potential Collapse of Inshore Marine Ecosystems. Inshore marine ecosystems are under increasing pressures from human activities and climate change. But overfishing outweighs all other impacts on these ecosystems and could cause their collapse, including through reducing their resilience to climate change. This is important to SIDS because of their disproportionately high dependence on inshore ecosystems for livelihoods and food security, and their increased vulnerability to extreme events with reduction in the protective function of these systems. There are many options for addressing overfishing and building ecosystem resilience to climate change, including more effective implementation of the FAO Code of Conduct for Responsible Fisheries and locally-managed marine areas.

Sustainable Use of Natural Resources

009. Degradation and Scarcity of Freshwater Resources. Most SIDS are experiencing increasing shortages of freshwater as a result of multiple anthropogenic pressures and climate change impacts on their already vulnerable freshwater resources. Water scarcity will have far-reaching impacts on sustainable development in SIDS and could even jeopardize the continued human habitation of some islands. Progress towards the Millennium Development Goal of improving access to safe drinking water has been very poor in most SIDS regions. Response options include reducing the degradation and loss of freshwater resources through technical measures, rainwater harvesting, water reuse/recycling, building synergies between the water and energy sectors, low-cost wastewater treatment facilities such as artificial wetlands, and integrated water and land management.

010. Coastal Squeeze and Loss of Associated Ecosystem Services. The accelerating loss of littoral and mangrove forests in SIDS can be attributed to growing human pressures on land coupled with sea level rise and associated impacts, which are creating the phenomenon of 'coastal squeeze'. On many islands, these are the only forests that exist and their loss reduces a significant portion of the available ecosystem services and most plants available for livelihood security. The reduction in the available land is of concern on some volcanic islands. Measures to address coastal squeeze include sustainably using these forests and restoring degraded ones, strengthening capacity for integrated coastal zone management, and linking the protection of coastal vegetation with climate change adaptation.

011. Reaching the Limit of Land Capacity. Most SIDS are characterized by limited land resources, which are under increasing demands and intense pressures from multiple and competing uses as well as from climate change and extreme events. An emerging concern is that these cumulative pressures may lead to the land carrying capacity being exceeded. Land is closely linked to freshwater and there may be tipping points where the degradation of both resources rapidly accelerates, threatening the island's habitability. To avoid this, SIDS need to judiciously use their available land resources and ensure proper physical planning and land use management based on estimates of human carrying capacity, and embrace more sustainable consumption and production patterns.

012. Harnessing Renewable Energy Opportunities. Oil imports account for the largest claim on foreign exchange earnings in many SIDS, severely draining their limited financial resources and increasing their vulnerability to external economic shocks and trade imbalances. SIDS are well endowed with renewable energy (RE) potential but face a number of barriers to RE development including unavailability of appropriate technology and limited economy of scale. RE provides opportunities to improve the socio-economic wellbeing of SIDS people, achieve the Millennium Development Goals, and reduce carbon dioxide emissions. Removing barriers to RE deployment includes, among others, developing and implementing SIDS-appropriate measures and strategies; appropriate policy, institutional, and regulatory interventions; public-private partnerships; and adaption and implementation of successful initiatives.

013. Balancing the Opportunities and Risks of Exploring SIDS' Unexploited Natural Resources. SIDS possess substantial unexploited natural resources in terrestrial and marine areas. Increasing demands coupled with depletion of conventional resources are driving the exploration of these resources, which present significant opportunities for SIDS to meet many social and economic goals. However, embarking on these new ventures places diverse responsibilities on SIDS who face many constraints in sustainably exploiting these resources and minimizing potential negative human and environmental impacts. SIDS should consider adopting internationally accepted best practices, the precautionary principle and adaptive management strategies; ensuring consistency with pre-existing policies and guidelines; strengthening human and technical capacity; and establishing collaborative arrangements for management of new transboundary resources.

014. Developing an Ocean-based Green Economy. For most SIDS, transitioning to a 'green economy' implies an ocean-based green economy because of the socio-economic importance of the ocean to SIDS, many of which are already experiencing widespread degradation of coastal ecosystems and approaching the limit of their land carrying capacity. There are many practical and political challenges in this transition, and risks and opportunities must be scientifically assessed. Approaches and solutions exist that can be adapted by SIDS and governments have an important role to play in providing the enabling conditions for this transition. Since many ocean issues have a regional/global dimension, it is important for SIDS to foster regional cooperation in developing an ocean-based green economy.

Managing Threats from Chemicals and Waste

015. Globally-emitted Contaminants Affecting SIDS. Increasingly, SIDS are being impacted by harmful substances that originate from distant sources beyond their boundaries. The changing climate could increase the long-range transfer of these pollutants. This issue is of particular concern to SIDS who have limited capacity to monitor and manage their impacts. Preventing the release of these substances is the only long-term solution, which calls for the precautionary principle in their production and use globally. Individually, most SIDS do not have the capacity to effectively participate in relevant international deliberations, and they should take advantage of collective mechanisms to increase their influence on the global stage. Research and more comprehensive interventions based on existing knowledge are also required.

016. Indiscriminate and Increasing Use of Pesticides. SIDS import many pesticides among which are persistent organic pesticides (POPs). Their indiscriminate and increasing use is endangering human health, fragile island ecosystems and biodiversity as well as agricultural production, and contaminating freshwater resources. Alternative practices such as biological control and eco-friendly pesticides are available. But SIDS governments should look beyond the replacement of harmful pesticides to more sustainable practices such as Integrated Pest Management to optimize the contribution of pesticides to agricultural productivity and food security while reducing their adverse impacts. Some SIDS have created legal structures and authorities for managing chemicals at both national and regional levels, which could be replicated by other SIDS.

017. Greening the Waste Sector: Turning Waste to Opportunities in SIDS. Population growth, socio-economic development, and lifestyle changes are increasing the quantity of waste and altering its composition in SIDS. National waste management strategies still focus on end-of-life solutions, with most of the waste collected disposed of in sanitary landfills. While waste management presents various challenges, it also provides opportunities for greening SIDS' economies through turning waste into resources. This requires a shift towards reducing, reusing, and recycling using SIDS-appropriate technologies. Opportunities should be explored for mobilizing investments and technology transfer and strengthening technical and human capacity. Among these are strategic partnerships and regional cooperation including joint investment in central waste management facilities.

Addressing Climate Change and Its Impacts

018. Disproportionate Impact of Climate Change and Sea-Level Rise in SIDS. Climate change and sea level rise have a disproportionately greater impact on the environment and socio-economic development in SIDS. Given that climate change and sea level rise impacts are expected to long persist even if greenhouse gas emissions are stabilized, implementation of a comprehensive package of adaptation and mitigatory measures is urgently needed. These should be based on the specific needs of SIDS and utilize available resources, including local knowledge and traditional skills and technologies. Collective representation would strengthen SIDS' influence in global arenas. The international community also needs to increase efforts towards changing the current trajectory of greenhouse gas emissions and providing support to SIDS for adaptation.

019. Intensification of Extreme Events; External Shocks; and Increasing Vulnerability of SIDS. An increase in the frequency and intensity of extreme events and growing exposure in developing countries have been documented. SIDS have also been affected by global financial and economic shocks. They have a disproportionately high inherent and increasing vulnerability to these perturbations, whose impacts are intensifying in many of them. A strategic approach that combines local and scientific knowledge is needed to build resilience to extreme events and external shocks and reduce risk from natural disasters. The small size of SIDS provides many advantages for building internal sustainability and resilience to external impacts. Development of improved disaster and shock-related insurance is also critical.

020. Climate and Environmental Change Driving Population Displacements. Emigration of people to foreign countries in search of better opportunities has long been a feature of SIDS. But population displacement, including internally, is increasing because of continuing environmental degradation, climate change, and sea level rise especially in low-lying islands. Some islands could become uninhabitable and others are faced with the potential loss of their entire territories. Population displacements present a number of challenges for the islands themselves and the host countries. Several options are available for addressing the issue of environmentally-induced migration including reducing environmental degradation, including environment migration challenges in countries National Adaptation Programmes of Action and broadening of immigration policies across countries to include environmental migrants. These need to be underpinned by an appropriate international and regional legal regime. But it must also be recognized that migration also has certain benefits.

Introduction

Why a SIDS Foresight Exercise?

Governments, the UN community and the world at large are faced with many well-known environmental challenges that require attention and action. At the same time, new and emerging environmental issues are regularly identified for which appropriate responses need to be developed and implemented. The questions arise about which emerging issues most urgently require policy attention and what the possible solutions are. UNEP sought to answer these questions by conducting a rigorous and systematic exercise in 2012 – the "UNEP Foresight Process" on Emerging Global Environmental Issues. The outcome of the process was released in a report entitled *"21 Issues for the 21st Century: Results of the UNEP Foresight Process on Emerging Environmental Issues"*[1].

The "UNEP Foresight Process" primarily identified emerging environmental issues and solutions on a global scale and perspective. But what would the priority emerging environmental issues be from the perspective of Small Island Developing States (SIDS)? Would the distinctive scale and perspective of the SIDS provide new insights on issues to which governments and the UN community should give priority in order to contribute to their sustainable development? To answer these questions, in 2013 UNEP carried out a foresight exercise centred on the SIDS. The outcome of the exercise is presented in this report, which is one of UNEP's contributions to the Third International Conference on SIDS that will take place in Samoa in September 2014. The content aligns with one of the four thematic foci of the conference: "identify new and emerging challenges and opportunities for the sustainable development of SIDS and ways and means to address them".

Definition of "SIDS' Emerging Environmental Issues"

The concept of "emerging issues" is subjective, with different definitions being drawn up by different communities. For the UNEP SIDS Foresight Process, an emerging environmental issue is defined as any **positive** or **negative** issue that is:

- critical for sustainable development in the SIDS.
- related to any of the three dimensions of sustainable development – environmental, social and economic – but with particular relevance to the environmental dimension.
- recognized as *very important* by the SIDS, but has not yet received *adequate attention* from the policy community. The interpretation of *very important* and *adequate attention* is left to participants in the foresight exercise.
- evidence-based, including scientific and traditional sources of knowledge.
- recognised as 'emerging' based on newness, which can be as a result of new knowledge, new scales or accelerated rates of impact, or a heightened level of awareness.

In the Foresight exercise, UNEP recognized the need to:

- select issues that if not addressed now will have significant future impacts on sustainable development in the SIDS;
- focus on threats and direct causality as well as opportunities to address challenges using new technologies and solutions;
- address cumulative – often local – effects that are chronic in nature; and
- draw attention to vulnerable people and places.

The UNEP SIDS Foresight Process

The process was designed to encourage the creative input of participants by stimulating debate on emerging issues of importance in SIDS. At the core of the process was a small island developing state Foresight Panel consisting of 11 small island developing state experts spread across the three small island developing state regions – the Caribbean; the Pacific; and Africa, the Indian Ocean, the Mediterranean and the South China Sea (AIMS)[2]. To increase the legitimacy of the process, UNEP intentionally selected experts from a wide range of disciplines to be representative of the global community of SIDS. Views were also solicited from a wider community of knowledgeable experts from across the globe.

The process consisted of the following phases:

- *Canvass of ideas on emerging environmental issues*. UNEP solicited views, insights and descriptions of important emerging environmental issues from the Foresight Panel, other experts on SIDS and the UNEP community. This resulted in a preliminary list of 54 issues, which were grouped into different environmental themes and compiled as a background document for the Foresight Panel workshop.
- *Foresight Panel workshop*. Panel members debated the 54 issues in a systematic manner, with the assistance of a professional facilitator. Some issues were combined and/or redefined, while others were dropped, resulting in a list of 22 emerging environmental issues.
- *Electronic Consultation*. An online questionnaire was prepared with descriptions of the 22 issues. Participants in the electronic consultation were requested to score the issues between 1 and 10 in terms of their importance to the sustainable development of SIDS, to comment on the appropriateness of the issues and a possible way forward, and to suggest additional issues. In total, 54 experts responded to the electronic consultation.

1 For more details of the global UNEP Foresight Process and its outcome, see http://www.unep.org/publications/ebooks/foresightreport/

2 See acknowledgement page for list of Foresight Panel Members.

- *First Draft of Report and Peer Review*. The UNEP secretariat prepared a report on the 22 issues incorporating the inputs of the Panel and respondents to the questionnaire. The draft report was then subjected to peer-review, through the UNEP Global Environmental Outlook for SIDS Community of Practice[3], by the Foresight Panel, UNEP community, and other SIDS experts.
- *Final Report*. Based on the comments from the review process, which agrees with that received during the electronic consultation, four of the issues were merged into two issues resulting in a final list of 20 emerging environmental issues. The report was then finalized, incorporating comments received from the reviewers.

It must be noted that the UNEP Foresight Process for SIDS was part of a broader effort in which the UN Department of Economic and Social Affairs (DESA) was also involved. The Foresight Panel workshop was held concurrently with the UN DESA workshop, which aimed at identifying emerging socio-economic challenges and opportunities for the sustainable development of SIDS. Although the two workshops were separate, there were brief joint sessions in which the interconnectedness between environmental and socio-economic issues was discussed. The DESA workshop resulted in a list of 15 socio-economic issues. This report is therefore divided into two parts. Part 1 describes the 20 environmental issues identified through the UNEP SIDS Foresight Process, while Part 2 describes the 15 socio-economic issues identified through the DESA workshop.

In coming up with the final list of environmental and socio-economic issues, participants at the two workshops recognised that the social, economic, and environmental dimensions of sustainable development are intimately linked, especially in SIDS. It was acknowledged that many of today's environmental challenges can be traced to socio-economic activities and these environmental challenges, in turn, impact on the socio-economic well-being of humans and the society. Participants also recognised the diversity of SIDS and the fact that SIDS are not readily comparable and that different issues impact different SIDS nations in different manners. This must be kept in mind when reading this report.

3 http://uneplive.unep.org/community/

Part I

UNEP
Environmental Issues

The Issues and their Description

Seventeen of the issues identified through the UNEP SIDS Foresight Process fall within different environmental themes. The other issues are cross cutting in nature such as capacity building, recognition and use of SIDS' traditional knowledge, and indicators of sustainable development in SIDS. While the 20 issues presented in this part of the report have been grouped according to environmental themes, they should be viewed in a holistic and integrative manner. Table 1 presents the entire list of environmental issues based on the grouping and without any particular order of priority.

Table 1: The 20 SIDS' Environmental Issues

Issue ID	Issue Title
	Cross-cutting issues
001	Beyond GDP – Developing Appropriate Indicators for SIDS' Sustainable Development
002	Unique Human Capacities for Island Sustainability
003	Synergizing Indigenous and Local Knowledge and Modern Science as a Basis for Sustainable Island Development
	Rehabilitating Biodiversity and Ecosystem Services
004	The Continued Threat of Invasive Alien Species
005	Averting the Loss of Tropical Montane Cloud Forest
006	Breakdown of Sand and Sediment Budget due to Biodiversity Loss
007	Decline of Agrobiodiversity and Ecosystem Functions Affecting Food and Livelihood Security
008	Overfishing and Potential Collapse of Inshore Marine Ecosystems
	Sustainable Use of Natural Resources
009	Degradation and Scarcity of Freshwater Resources
010	Coastal Squeeze and Loss of Associated Ecosystem Services
011	Reaching the Limit of Land Capacity
012	Harnessing Renewable Energy Opportunities
013	Balancing the Opportunities and Risks of Exploring SIDS' Unexploited Natural Resources
014	Developing an Ocean-based Green Economy
	Managing Threats from Chemicals and Waste
015	Globally-emitted Contaminants Affecting SIDS
016	Indiscriminate and Increasing Use of Pesticides
017	Greening the Waste Sector: Turning Waste to Opportunities in SIDS
	Addressing Climate Change and its Impacts
018	Disproportionate Impact of Climate Change and Sea-level Rise in SIDS
019	Intensification of Extreme Events and External Shocks and Increasing Vulnerability of SIDS
020	Climate and Environmental Change Driving Population Displacements

Cross-cutting Issues

Issue 001 Beyond GDP: Developing Appropriate Indicators for SIDS Sustainable Development

Current Situation

Many experts, for example Stiglitz and others (2009), Costanza and others (2009; 2014) and Jabobs and Cozijns (2012), have criticized the use of the generally accepted Gross Domestic Product (GDP) as the standard indicator of economic progress[4]. Some have argued for a more appropriate indicator that not only incorporates the environment and its services but also takes into consideration the global challenges of the 21st century such as climate change, poverty, natural resource depletion, human health, and quality of life. An over-reliance on income growth, which appears as an increase in GDP, contributes to policies and interventions that could encourage depletion of natural resources (Bacon and others 2010; WAVES 2012). The Stiglitz Commission on the Measurement of Economic Performance and Social Progress proposed a "beyond GDP approach", aimed at developing indicators that are more inclusive of natural capital and the environmental and social aspects of progress in a quest to support sustainable development (Stiglitz and others 2009).

Because of the unique ecological, cultural, and socio-economic characteristics of the SIDS including their small but growing populations, limited natural resources, insularity, remoteness and isolation, vulnerability to natural disasters and other external shocks, and biologically diverse but fragile ecosystems (Briguglio 1995; Lagossah 2007) it is imperative to develop appropriate sustainable development indicators for SIDS. This need has been mentioned in several important documents including the Barbados Programme of Action for the Sustainable Development of Small Islands States[5] and the Mauritius Strategy[6]. The current push for a progress measurement that is "beyond GDP" provides an opportunity for the SIDS to lead in defining holistic models of sustainability and human well-being, and to promote them globally.

Importance and Relevance to SIDS' Sustainable Development

Many commentators believe that the use of GDP per capita as a measure of progress of SIDS is misleading, erroneous, and inexact. The GDP-based indicators do not consider many of the features of a small and limited economy like that of the SIDS (Blancard and Hoarau 2013). Further, the current method of evaluating development does not adequately capture the cultural and social richness, priorities, and unique natural environment and other non-monetary values of SIDS. As a consequence, SIDS are misclassified in terms of their real socio-economic development, which could lead to their marginalization and continued environmental degradation. Without appropriate indicators of sustainable development, SIDS risk losing their cultural, environmental, and socio-economic integrity.

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Moving Forward

Several initiatives are currently ongoing to develop appropriate measurements of progress in the context of SIDS that takes into consideration their ecological, cultural, and socio-economic characteristics (for example, Fontalvo-Herazo and others 2007; Guillaumont 2007; Briguglio 2011; Jabobs and Cozijns 2012; Marion and others 2012; Blancard and Hoarau 2013). While generic indicators that apply to all SIDS can be developed, different indicators might be more appropriate for different groups of SIDS based on their specific socio-economic and ecological characteristics. In moving forward, SIDS should collaborate in encouraging these efforts, which require cooperation among academics, policy makers, and other stakeholders within the SIDS. Initiating this type of cooperation would also avoid "reinventing the wheel", and could help mobilize support from the international community. Furthermore, SIDS' effort towards developing indicators should take into consideration the ongoing global effort towards developing Sustainable Development Goals and the Post-2015 Development Agenda. It is important that any national or regional framework supports the global efforts but flexible to accommodate SIDS specific context and issues.

As these efforts also require credible data and indicators, the capacity of SIDS to identify, collect, test, and validate appropriate indicators needs to be strengthened. This would help to ensure that development pathways and monitoring and evaluation frameworks better reflect the

4 GDP was not designed to measure sustainable development or human well-being in the first place, but for measuring income generated from marketed economic activities. Unfortunately, promoting its growth has been the primary national goal of many countries since the Second World War (Costanza and others, 2014).

5 http://www.un.org/documents/ga/conf167/aconf167-9.htm

6 http://www.unesco.org/new/en/natural-sciences/priority-areas/sids/about-unesco-and-sids/mauritius-strategy/

realities, aspirations, and sustainable development goals of SIDS. Furthermore, given the many challenges associated with the development of indicators including the need for a sound theoretical base, research in the field need to be encouraged. Also, the role of indigenous and local knowledge in identifying appropriate indicators and the importance of a participatory approach (Fraser and others 2006; Fontalvo-Herazo and others 2007; Hermans and others 2010) should not be ignored.

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Issue 002 Unique Human Capacities for Island Sustainability

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Current Situation

There are indications that the paucity of job skills in the green sector may be holding back society's ability to cope with global environmental change (UNEP 2012a). This was previously recognized including in a 2010 International Labor Office report that indicated that the lack of relevant skills may hinder the opportunities for the greening of economies (ILO 2010). In the same vein, the UNEP Green Economy report (UNEP 2012b) suggests that current shortages in skilled labor may *"frustrate efforts by governments to transition to a green economy and deliver the expected environmental benefits and economic returns"*. In addition to the gap in job skills, similar deficiencies in modes of learning, management practices, and research all undermine efforts to deal with adverse global environmental change.

Undoubtedly, SIDS are among those countries where the lack of human capacity for supporting sustainable development is of major concern. According to the ILO, for instance, virtually all Pacific island countries lack adequate skilled and trained workforce[7]. Most SIDS lack human resources in critical fields including governance and economics as well as science and technology that are required for a holistic and systems approach to sustainable development. This skill shortage can be ascribed to several

7 http://www.ilo.org/wcmsp5/groups/public/@asia/@ro-bangkok/documents/projectdocumentation/wcms_120577.pdf

factors including the small scale of island systems, which creates unique challenges that require specialized skill types for their management, inadequate financial resources for human capacity development, and the emigration of existing skilled labor force – SIDS experience on average a 50 per cent loss of talent and skills, a figure that is as high as 75 per cent in some SIDS (Croix and others, 2013). The situation is further aggravated by the disproportionate effects of global environmental change resulting in a need for more, new and specialized skill types. The UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States suggests that lack of skills could severely hamper the ability of SIDS to manage climate change impacts (UN-OHRLLS 2009).

Importance and Relevance to SIDS' Sustainable Development

The prosperity of any nation ultimately depends on the productivity of its people. For SIDS to achieve sustainable development, it is important that its people are able to skillfully manage available resources in a sustainable manner. SIDS face unique sustainability challenges that will require particular skills, for example, to develop fit-for-purpose indicators of sustainable development, renewable energy technologies that are SIDS-appropriate, and technologies for sustainable exploration of untapped natural resources.

The human resource requirements for managing the environment and society under multiple pressures cannot be met by scaling down educational approaches and professional competences as in larger societies. Further, division of training into disciplines and specialties becomes increasingly inappropriate in many of the SIDS where the multiple functions of governance and environmental management fall on a few people. Given the aspiration of SIDS to transition to an ocean-based green economy, addressing the need for adequate and appropriate specialized skills in the SIDS becomes even more imperative. This transition presents an opportunity to re-align the education systems to support the delivery of the required skills and labour force for sustainable development.

Moving Forward

SIDS' education systems and training programmes need more efficient and innovative ways to address their chronic human capacity problem. Capacity building efforts should consider the unique characteristics of SIDS, the specific needs and development pathways of individual SIDS as well as the traditional values of island peoples. Solutions need to take into account local opportunities as well as restrictions (for example, teaching and training could be conducted in traditional languages) and be based on identified capacity-building needs.

There is an urgent need for a comprehensive assessment of the required human capacities for island sustainability. In addition, sustainable and effective capacity building

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institutions and cooperation are required (Ratter 2008). In this regard, the SIDS University consortium and establishment of technical cooperation among developing countries (TCDC) to enable SIDS to share expertise are important mechanisms.

SIDS could extend their educational curricula and programmes to better prepare students for jobs in a green economy. It is particularly important to provide interdisciplinary and multidisciplinary training that equips students to function effectively in the cross cutting nature of sustainability-related jobs (UNEP 2012a). Additionally, dynamic continuing professional development programmes could be initiated to prepare existing practitioners to adequately address the unique and changing challenges facing the SIDS.

The growing proliferation of information and communication technologies, including increasing availability of distance learning and online degree programmes is expected to enable a greater number of SIDS citizens to access higher education and may help stem talent loss. Modern information technologies can also overcome problems of access to information and data integration, and need to be designed to support generalist managers and local resource users. Island governments may therefore need to give priority to communications infrastructure and education that open new possibilities for participation in the global information network, oriented towards opportunities that will enhance, rather than threaten, island environmental sustainability and values.

Capacity to bridge science and policy and to combine science with traditional knowledge and local cultures is

also needed. Training local people to use both traditional knowledge and modern science will root sustainability in island communities and resource users, thereby strengthening local environmental management as well as monitoring. For example, coastal communities and fishers could be trained and engaged as environmental wardens and a core of local people who are knowledgeable about their island issues could be maintained in the field. Involvement of the youth in sustainable development matters is also important. Therefore, adequate investment, including from public and private sectors as well as from the international community, should be made in building their capacities.

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Issue 003 Synergizing Indigenous and Local Knowledge and Modern Science as a basis for Sustainable Island Development

Current Situation

Indigenous and Local knowledge (ILK) about the environment and ecosystems have enabled societies to survive and flourish over millennia. There is a growing body of evidence that ILK can complement modern science in the search for sustainable and alternative solutions to many of today's challenges (for example, Cullen and others 2007; Mercer and others 2007; Nakashima and others 2012; Raygorodetsky 2013; Thaman and others 2013). It has been found, for example, that community narratives related to issues such as climate change, disaster mitigation, and ecosystem sustainability are useful for storing, communicating, and activating complex environmental information and for integrating scientific, normative, and cultural dimensions (Gomez-Baggethun and others 2012; Thornton and Scheer 2012; Huntington and others 2013; Lejano and others 2013; Levine and Sauafea-le'au 2013).

SIDS are a custodian of a wealth of ILK that could complement scientific understanding and assist with policy formulation that is more appropriate to local realities. Many SIDS possess cultural knowledge and a philosophy that for millennia have been based on a sustainable existence, as seen for example, in traditional practices related to the efficient use of energy and water resources[8]. But the loss of ILK is now a very critical issue (UNESCO 2011). This can be attributed to the ageing and death of the older generation of knowledge holders as well as globalization and market economics that are quickly eroding this valuable asset. The latter are often disregarded, as seen for example in the Caribbean (Mercer and others 2012). Despite the growing acknowledgement of the importance of synergizing ILK and modern science for effective sustainable applications in SIDS, the process of integration can be daunting (Mercer and others 2009; Raymond and others 2010). In search of quick fixes, more often top down approaches based on modern science are favoured by decision makers rather than those based on cultural values and local knowledge.

Importance and Relevance to SIDS' Sustainable Development

Because of the unique nature and circumstances of SIDS, externally derived strategies for addressing SIDS sustainability challenges may not, on their own, be appropriate. ILK, therefore, remains a critical source of

8 See: http://www.teachingclimatelaw.org/using-renewable-energy-and-desalination-for-climate-mitigation-and-adaptation-in-small-island-developing-states-and-coasts-of-arid-regions/ and http://www.stakeholderforum.org/sf/outreach/index.php/inf2day1home/92-inf2day4/758-inf2day4item6

information for addressing environmental and sustainable development issues in SIDS. To meet increasing challenges, SIDS require new and innovative approaches and tools that are adapted to local conditions, cultures, and community needs. Such innovation can be facilitated by harnessing and integrating their wealth of ILK with modern science. For instance, using ILK in synergy with modern science is an important tool for exploring scenarios of the long term impact of climate and other forms of environmental change and how island communities have adapted to them in the past. This could make a significant contribution to building resilience and developing and implementing future adaptation and development strategies.

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Moving Forward

While recognizing that there were reasons for moving away from traditional development systems (for example, traditional agricultural practices that are ineffective in meeting the needs of growing populations), efforts that harness and supplement ILK by modern science need to be adequately recognized, valued, and enabled. This approach to management of island systems depends on refocusing and reorienting development aspirations away from conventional development.

A starting point is to validate and document relevant ILK for appropriate use and future reference. ILK should be incorporated into the educational syllabus at all levels in SIDS. Professional training facilities, for example, for the agricultural and environmental sectors, should include modules on ILK and associated practices. Further, the youth should be empowered to participate in new innovations that integrate ILK.

More research should be carried out on ILK and its integration with modern science and technology to develop appropriate strategies. Many Caribbean SIDS have established National Science and Technology Councils that can be used as a framework for the establishment of a network of science and technology agencies in SIDS. Consideration should be given to using such platforms for the promotion and integration of ILK with modern science.

There are examples in which a combination of traditional and modern science has been used in environmental management both within the SIDS (for example, Vierros and others 2010; Mercer and others 2012; Holdschlag and Ratter 2013) and outside the SIDS, including in Canada (Failing and others 2007), New Zealand (Moller and others 2004), the United States (Shebitz 2005), and Spain (Gomez-Baggethun and others 2012). Lessons learnt from these efforts can be adapted by the SIDS as appropriate.

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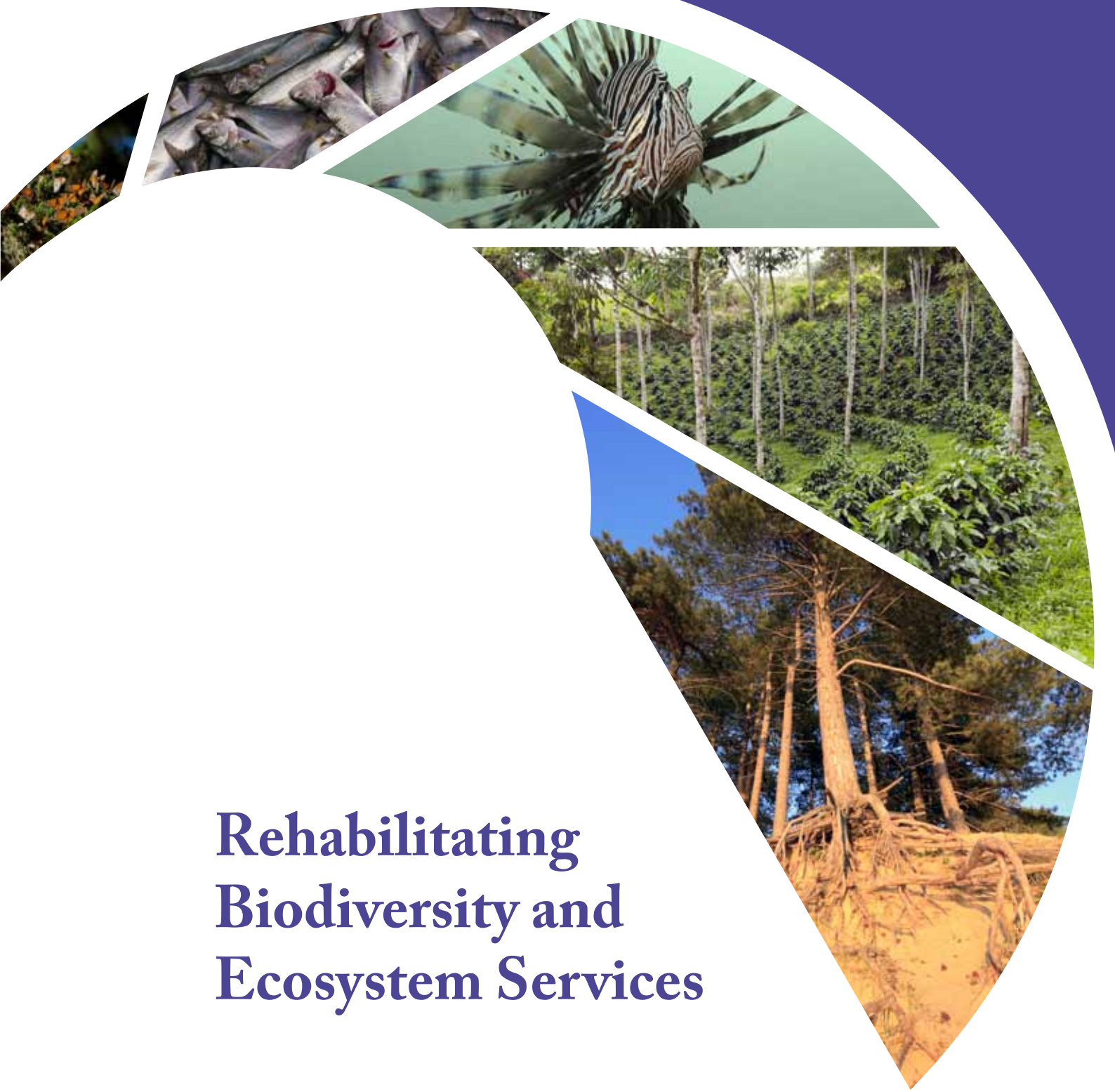

Rehabilitating Biodiversity and Ecosystem Services

Issue 004: The Continued Threat of Invasive Alien Species

Current Situation

According to the Millennium Ecosystem Assessment (MA 2005), biological invasions are one of the major causes of biodiversity loss worldwide. In fact, Mainka and Howard (2010) referred to biological invasion alongside climate change as the two key drivers of biodiversity loss. Increased development and frequency of air, land, and sea transport and inability to adequately monitor loading and movement of carriers and points of entry as well as monitor marinas has increased significantly the risk and frequency of entry and spread of invasive alien species (IAS) in SIDS. Compounding this is climate change, which would most likely exacerbate the spread of IAS (Mainka and Howard 2010). This is corroborated by the IPCC 2014 assessment, which identified IAS as one of the stressors that could increase the risk of extinction of both terrestrial and freshwater species from climate change during and beyond the 21st century (IPCC 2014).

Managing IAS is a critical issue because they represent a serious present and potential threat, not only to biodiversity, but also directly or indirectly to economic development, health, agriculture, and tourism globally (CBD 2010). Yet, IAS have not received adequate attention. Although their impacts in the SIDS are well documented, efforts at addressing the issue have been slow (Brown 2012). The full range of problems associated with IAS still lacks adequate political recognition and too few coordinated actions are in place or are effective in most parts of the world, including in the SIDS. To quote UNEP's Executive Director *"far too many governments have failed to grasp the scale of the threat from invasive species*[9]*"*.

Importance and Relevance to SIDS' Sustainable Development

IAS constitute one of the most serious but under-acknowledged threats to sustainable development in SIDS. The impacts of IAS are enormous, insidious, and difficult to reverse, especially given the particularly high vulnerability of SIDS arising from their small size, geographic isolation, and ecological fragility. The risks are further magnified because of the limited capacity of SIDS to address the threats on the one hand and the astronomical financial and management costs on the other. A disproportionate number of all extinctions and extirpations, devastation of important crops, and death of indigenous human populations have been caused by invasive species (Thaman 2013). IAS are now considered the leading cause of species extinction on islands, according to the International Union for Conservation of Nature (IUCN)[10].

IAS pose a severe threat to both aquatic and and terrestrial ecosystems in SIDS. Available data shows that only 16 per cent of the world's marine ecoregions are

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IAS-free (Molnar and other 2008). An increasing body of evidence shows that marine IAS are an extremely serious, but less understood, threat to fisheries, coral reefs, and other marine ecosystems. This insight is well illustrated by the lionfish (*Pterois sp*), which has invaded the wider Caribbean region, including the Greater Antilles, the major part of the Lesser Antilles, and the continental countries bordering the Gulf of Mexico to Central and Latin America[11]. With its high reproduction rate and aggressive predatory behavior, the lionfish could quickly decimate coral reef fish communities and could become one of the most disastrous marine invasions in history. On heavily invaded sites, lionfish have reduced their fish prey population by up to 90 per cent (REEF 2011). Recent research shows that the lionfish is negatively impacting coral and sponge communities, including in the Bahamas (Green and others 2011; Lesser and Slattery 2011).

Island terrestrial and freshwater systems have also been subjected to significant introductions of alien species that have replaced indigenous organisms and drastically changed the ecosystems. In many Pacific and Caribbean island areas at low elevations (below 400 m), IAS have almost entirely replaced or dominated native species due to land use change that favours them. According to CBD (2010), IAS are directly or indirectly responsible for up to two-thirds of the world's terrestrial species extinctions of which close to 95 per cent have occurred on islands. Birdlife International (2008) indicted the introduced brown tree snake in the extinction of most of the native bird species of Guam Island and in the decimation of birds populations on the nearby Northern Mariana Islands. In a more recent study, Birdlife International (2013) reported that three-quarters of all threatened bird species on small islands are at risk from introduced species, especially introduced microorganisms and predators such as rats and cats.

IAS poses a real danger to food security, human health, and export earnings from economic sectors including fisheries, agriculture, and tourism. For example, economic

9 http://news.bbc.co.uk/2/hi/science/nature/8615398.stm

10 http://iucn.org/about/union/secretariat/offices/iucnmed/iucn_med_programme/species/invasive_species/

11 http://www.car-spaw-rac.org/?Vulnerabilite-de-la-grande-region,447

damages associated with alien mammal predators in Seychelles have been estimated to be roughly USD21 million per year (Mwebaze and others 2010). Thaman (2013) warned that the oriental fruit fly, which has caused millions of dollars in damages in Australia, Hawaii, and Tahiti, could devastate the fruit export industry of Cook Islands valued at 3 million New Zealand Dollars. Particularly serious in recent years has been the loss of wildlife, property, and food and livelihood security in the Pacific Islands caused by ants, fruit flies, termites, and plant pathogens, which have cost millions of dollars in terms of control, lost cash and subsistence incomes, and human health (Thaman 2013). The IPCC 2014 report (and references therein) stated that the aggressive spread of the invasive giant African snail across the Caribbean, Indo-Pacific islands and Hawai'i as well being a severe threat to native snails and other fauna, flora, crop agriculture, is also a vector of human diseases such as meningitis. Unless they are made a priority, IAS will continue to seriously undermine food security and human health, and increase the vulnerability of most SIDS to climate change, environmental, economic, and health challenges beyond their control.

Moving Forward

Management action against IAS should aim to prevent or minimize new species introductions, establishment and spread, eradicate or control established populations, and restore native flora and fauna[12]. Since eradication is extremely difficult after a species has become established and control very expensive, preventing new introductions should be given the highest priority especially for vulnerable ecosystems. Preventive measures include developing guidelines and codes of conduct for all major sectors – agriculture, tourism, fisheries, forestry, trade, and health; eliminating economic incentives that encourage IAS introduction; putting in place quarantine and border control facilities as well as legislative and regulatory actions (Townsend 2009). Successful removal of some IAS has been demonstrated, for example in Mauritius, where alien plants were weeded from forested areas, resulting in ecosystem recovery and increase in species richness (Baider and Florens 2011).

IAS management would benefit greatly from coordinated action and investment and are best addressed as a cross-boundary issue at the regional level. Examples of existing collaborations include the Regional Strategy for the Control of Invasive Lionfish in the Wider Caribbean[13], the Regional Strategy on Shipping-Related Introduced Marine Pests in the Pacific Islands[14], the Pacific Invasives Partnership[15], and at the international level, the GloBallast Partnership[16]. These initiatives could be assessed with the aim of adapting or replicating them across the SIDS. The establishment of inter-island biosecurity[17] initiatives could also be an effective mechanism to prevent the spread of IAS within island groups.

There is a need to raise the profile of IAS as an economic and political issue across the SIDS, as was done for example through the 2013 Forum Communique by Pacific Leaders[18]. Also, improved awareness-raising involving communication professionals and capacity building efforts to help countries manage IAS need to be put in place. Capacity building can be facilitated through sharing of expertise and experience using regional networks such as the Pacific Invasive Learning Network (PILN)[19]. It might be worthwhile to establish such networks across the SIDS.

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Given that the problem of IAS is still not well understood, research and knowledge development on the various aspects of IAS including their ecology, impacts, and control should be encouraged. This will help ensure that strategies and policies on IAS are based on the latest scientific knowledge, as called for by several experts and organizations involved in IAS issues[20].

12 See: http://www.cbd.int/island/invasive.shtml and http://www.unep.org/regionalseas/publications/brochures/pdfs/invasive_alien_brochure.pdf

13 See: http://www.icriforum.org/sites/default/files/ICRI_lionfish_Strategy_En.pdf

14 See: http://www.sprep.org/publications/shipping-related-introduced-marine-pests-in-the-pacific-islands-a-regional-strategy

15 See: http://www.sprep.org/Pacific-Invasives-Partnership/invasive-partnerships

16 http://globallast.imo.org/index.asp?page=GBPintro.html&menu=true

17 Biosecurity measures aims to prevent the risk of transmission of infectious diseases in crops and livestock, quarantined pests, invasive alien species, and living modified organisms (Koblentz, 2010)

18 See: http://pacificpolicy.org/wp-content/uploads/2013/09/2013_Forum_Communique.pdf

19 See: http://www.sprep.org/piln

20 See: http://iucn.org/about/union/secretariat/offices/europe/?14098/Science-first-say-235-experts-on-the-EU-proposal-on-invasive-alien-species

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Issue 005: Averting the Loss of Tropical Montane Cloud Forests

Current Situation

Tropical montane cloud forests (TMCFs)[21] are among Earth's most threatened and most vulnerable yet neglected terrestrial ecosystems (Peh and others 2011; Toledo-Aceves and others 2011; Ponce-Reyes and others 2012). Many of these forests lack any form of protection, for example, those in the South Pacific region (Meyer 2010). Where management programmes exist, they are usually ineffective, usually because of inadequate resources (Toledo-Aceves and others 2011). Management is also constrained because of inadequate information including on their spatial distribution, biological richness, and ecological diversity (Scatena and others 2010; Goldsmith and others 2011), including in many of the SIDS.

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Major threats to TMCFs include conversion to agriculture and grazing lands, over-harvesting, alien invasion, infrastructure development including roads and hydroelectricity, and mining activities (Meyer 2010; Scatena and others 2010) as well as rising temperatures due to climate change. Retreat and disappearance of TMCFs reduce their "sponge-like effect" or capacity to extract moisture from the clouds and slowly release it into the hydrologic system, with potentially serious consequences for water catchment areas and freshwater supply (Foster 2001; Bruijnzeel 2004). Authors including Foster (2001), Mulligan (2010), and Ponce-Reyes and others (2012; 2013) indicate that the rate of decline of TMCFs is increasing globally, with an estimated 55 per cent already lost as a result of anthropogenic activities and global warming.

Importance and Relevance to SIDS' Sustainable Development

The importance of this issue varies among the SIDS as not all of them possess substantial cloud forests. Where TMCFs occur, they are of strategic importance for sustainable development as they play a critical role in the maintenance of water cycles, not only in the islands themselves but also globally. They are also important for nutrient cycling, as carbon sinks, and as biodiversity hotspots with high endemism[22] (Benner and others 2010; Toledo-Aceves and others 2011, Peh and others 2011). Because of the latter, they play an important role in the conservation of global biodiversity.

The retreat and disappearance of island cloud forests is analogous with the retreat of glaciers in high latitude regions in terms of the impact on water availability and increased incidence of serious flooding. In the affected SIDS, the loss of TMCFs can have potentially serious consequences for their limited freshwater resources, food security, and fragile island biodiversity. The resulting increase in shortage of freshwater and threat of downstream flooding from loss of TMCFs will exacerbate many natural resources and environmental problems already confronting these SIDS. Further, threats to freshwater resources in SIDS will be compounded by climate change, to which these resources are highly vulnerable. The availability of water for agriculture and food security will be another critical issue in the future. The loss of TMCFs will clearly affect agricultural sustainability in affected SIDS, not only because of potential

21 UNEP-WCMC defines cloud forests as "a type of evergreen mountain forest found in tropical areas, where local conditions cause cloud and mist to be frequently in contact with the forest vegetation". This characteristic results in a significant enhancement of net precipitation beyond normal rainfall contribution and a relatively higher biodiversity in terms of tree species of herbs, shrubs and epiphytes as compared to lowland rain forest. See http://www.unep-wcmc.org/tropical-montane-cloud-forest_229.html for more details

22 Endemic organisms are unique to a particular geographic region such as an island, river basin or other defined habitat type

impacts on water supply but also through increased exposure of the land to erosion. In turn, erosion can affect coastal ecosystems by promoting excessive sediment inputs to coastal areas and the subsequent increase in water column turbidity. Moisture-sensitive plants and animals may experience water stress. Therefore, loss of TMCFs is likely to have major adverse and systemic impacts on sustainable development in the affected SIDS.

Moving Forward

SIDS with significant expanses of TMCFs should adopt sound integrated water resources and forest management policies and practices. Such policies, where they already exist, can be extended to include TMCFs. Effective implementation and enforcement of existing forestry and environmental laws and policies is also important.

Sustainability strategies for TMCF management, as highlighted by Peh and others (2011) and Toledo-Aceves and others (2011), include adopting a landscape approach in conservation planning, practicing agroforestry, regulating agricultural activities, restricting logging activities and road access to ecologically sensitive areas, involving local communities in conservation projects, and ensuring that all developmental projects are subjected to environmental impact assessments. Other options include undertaking forest restoration activities. Protection against pressures such as encroachment from residential and industrial development and over-extraction will make these forests more resilient to climate change impacts.

Management and protection of cloud forests also require that relevant data and information be obtained and regularly updated. Efforts are needed to map these ecosystems to obtain information on their spatial distributions, which is required to inform the development of appropriate management strategies and to aid managers in monitoring any changes in their quality and extent. It might also be worthwhile to carry out a focused and methodical vulnerability assessment of TMCFs to help SIDS identify and focus on those systems at highest risk. Along this line, initiatives such as the BIORAP (Rapid Assessment of Biological Resources Programme), which mapped and assessed the biological resources of the cloud forest in Savaii in Samoa[23], should be expanded to other relevant SIDS.

23 http://www.savalinews.com/2012/06/25/stories-from-islands-in-the-clouds-%e2%80%93-the-savaii-biorap/

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Issue 006: Breakdown of Sand and Sediment Budget due to Biodiversity Loss

Current Situation

In a large proportion of low latitude beaches, lagoons, and offshore areas, up to 100 per cent of the sand and sediments are biogenic, that is, they are composed of the carbonate skeletal remains of dead marine organisms, most notably foraminifera, calcareous and coralline algae, corals, molluscs, echinoids, and sponges. Although beaches and lagoon sediments periodically disappear during storms, high wave activity, tsunamis, and other extreme events, they usually recover. However, in many islands, this recovery is being impaired (Thaman 2013). Evidence shows that replenishment of lagoon sediments may be decreasing and the rate of infilling of coral reefs with sediments that

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allow for vertical accretion[24] may decline in the future (Perry and others 2011).

No doubt, sea level rise and increased frequency of extreme weather events may contribute significantly to the loss of biogenic beaches and other coastal areas especially through inundation and coastal erosion. But recent research suggests that another factor may be implicated in the breakdown in the biogenic sand and sediment budget – a decrease in the rate of biogenic calcification[25] (for example, Andersson and Gledhills 2013; Browne and others 2013; Dawson and others 2014). This phenomenon is attributed to a decline in diversity and abundance of calcareous marine organisms material due to a combination of climate change impacts (including rising water temperature and ocean acidification) and anthropogenic activities (Yates and Moyer 2010; Shaw and others 2012; Ricke and others 2013). Studies on the atolls of the Pacific, such as Tuvalu and Marshall Islands, indicate that the abundance and diversity of foraminifera and calcareous algae are decreasing due to pollution (eutrophication) and interruption of along-shore and ocean-lagoon circulation caused by improper coastal engineering such as causeway/bridge development (Collen and Garton 2004; Xue 2004; Osawa and others 2010).

The disruption of the sand and sediment budget is further being aggravated by beach sand mining, which has other negative effects including destruction of important ecosystems, loss of habitats, increased shoreline erosion, reduced coastal protection from extreme events, and possible saline intrusion to groundwater (Young and Griffith 2009).

Importance and Relevance to SIDS' Sustainable Development

Beaches and near-shore marine sediments make up a disproportionately high fraction of the total land and coastal area on islands, especially on atolls and smaller islands. Coral islands in particular are among Earth's environments that are most vulnerable to climate change, and are likely to undergo major morphological change under most near-future ecological change scenarios (Perry and others 2011). Mortality of corals and subsequent decrease in the rate of biogenic sediment production can have severe impacts on the maintenance of those beaches that are composed mainly of biogenic material. Beaches support economic activities such as tourism in many SIDS.. They also perform other important functions including coastal defence against extreme events, habitats for a number of threatened species, and filtering out or absorbing land-based pollution. Therefore, loss of beaches can be expected to have serious environmental, social, and economic consequences for SIDS, as already being experienced.

Moving Forward

The problem can be tackled using a synergistic multi-prong approach, including maintaining the populations of calcareous marine organisms by reducing human impacts on marine ecosystems and increasing ecosystem and species resilience to climate change impacts, and minimizing the loss of existing beaches from erosion and sand mining. To minimize the impacts of erosion, rehabilitation works are commonly undertaken along coastal zones. These include the installation of rock revetment, mangrove propagation in high risk areas, and beach replenishment and management. It must be noted, however, that replenishment is expensive and can be detrimental to overall coastal dynamics. Hence, it must be carried out in a technical sound and sustainable manner.

The banning of beach sand mining in some SIDS has contributed to reducing erosion and helping ecosystem recovery. For example, in Mauritius, sand mining has been banned since 2001 and coastal rehabilitation work was undertaken to reduce coastal erosion[26]. Subsequent surveys have shown a regeneration of the marine ecosystem, with colonization of the sandy bottom by seagrasses, macroalgae, and corals (Environment Mauritius 2011). However, for beach sand mining to be effective, alternate sources of sand need to be identified.

There is a critical need for further research, including on ecological–geomorphological linkages to improve understanding of sediment production responses to

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24 the process of growth or increase, typically by the gradual accumulation of additional layers or matter.

25 Biogenic calcification is defined as the formation of calcium carbonate structures by marine organisms.

26 http://www.gov.mu/portal/sites/mid/WG2EnvBio.htm

different ecological and environmental change scenarios and dependent landform vulnerability.

Overall, effective management of beach and coastal areas will require the adoption of an integrated approach such as Integrated Coastal Zone Management, which incorporates ecosystem-based management, as described under Issue 010. Also, new science is emerging on estimating erosion particularly of low-lying coral islands (for example, Kench and Cowell[27]), which should be considered in making management decisions.

27 http://www.tiempocyberclimate.org/portal/archive/issue46/t46a2.htm

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Issue 007: Decline of Agrobiodiversity and Ecosystem Functions Affecting Food and Livelihood Security

Current Situation

It is now well-recognized that there is an ecological dimension to achieving food and nutrition security[28]. Several recent studies and assessments including Jackson and others (2005), FAO (2010), Sunderland (2011), Boelee (2011), UNEP (2012a), Benayas and Bullock (2012), and CBD (2013) have highlighted the important role that biodiversity and ecosystem functions play in food[29] production. Biodiversity is essential for productivity, ecosystem functions, and adaptability to climate change (Frison and others 2011). It is clear that agriculture[30] depends on a resource base comprised of land and water as well as ecosystem services such as soil formation, nutrient cycling, climatic condition, and on-farm and off-farm biodiversity, otherwise referred to as agrobiodiversity[31] or agricultural biodiversity. Agrobiodiversity provides important ecosystem services essential for food production including pollination, disease control, and pest management as well as resilience to abiotic stresses such as droughts and floods.

A breakdown in traditional species-rich agro-ecosystems and the loss of their agrobiodiversity and ecosystem functions is one of the most rapidly emerging threats to food and livelihood security in SIDS. Thaman (2008) stated that agrobiodiversity in the Pacific Islands is being rapidly eroded due to several factors including *"increasing monoculture, monetization, urbanization, and because mainstream biodiversity conservation initiatives concentrate on endemic or charismatic native organisms, intact terrestrial and marine ecosystems and species survival"*. This is corroborated by Sebastian and others (2010) who observed that agrobiodiversity is increasingly being threatened in the Asia, Pacific, and Oceania regions (which include some SIDS) due to simplification of ecosystems and species diversity as well as cultivation of a few preferred plant varieties. Other factors responsible for agrobiodiversity loss include mechanized farming, pest and disease infestations, use of inorganic fertilizers and pesticides, and habitat loss from deforestation.

Compounding this problem is the projected adverse impacts of climate change and extreme events on SIDS ecosystems and consequently their ability to support agriculture. In fact, climate change and associated sea level rise are already negatively impacting agriculture in SIDS and a recent assessment indicates that this is set to worsen (IPCC 2014).

Another important dimension to agrobiodiversity and ecosystem functions is the potential lost opportunities

28 See UNEP (2012a). Avoiding future famines: strengthening the ecological foundation of food security through sustainable food systems. http://www.unep.org/publications/ebooks/avoidingfamines/

29 Food here refers to crops, animals, and fish.

30 Although agriculture generally refers to the cultivation of plants and animals including fish, here agriculture refers to the cultivation of only food crops and rearing of livestock, unless indicated otherwise. Fisheries are discussed separately under Issue 008.

31 According to the Convention on Biological Diversity (CBD), *"agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes".*

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for achieving food and nutrition security because of underutilization of the various genetic resources available in SIDS (Jackson and others 2005; Hunter and Fanzo 2013; Johns and others 2013). FAO (2004) has indicated that the concentration on a few varieties or species of crops and animals and the underutilization of traditional genetic resources is becoming a growing concern for SIDS. Yet, little progress has been made in addressing this issue. Sebastian and others (2010) also reported that only a small proportion of the agrobiodiversity in the Asia, Pacific, and Oceania regions is being used in agricultural improvement programmes. As stated by Frison and others (2011), agrobiodiversity will not only serve as a traditional provider of traits for the incremental improvement of staples, but is also an essential element in the improvement of food production systems. Limited capacity, incomplete inventories and research, and lack of inter-institutional communication and collaboration continue to make it difficult to harness these opportunities.

Importance and Relevance to SIDS' Sustainable Development

Agriculture is a vital determinant of SIDS' food and nutrition status, and thus their socio-economic well-being. SIDS have a high dependence on subsistence agriculture and wild harvest for food security, income, and livelihoods. For example, 80 per cent of the population of Samoa and the Federated States of Micronesia (FSM) live in rural areas and are mainly dependent on subsistence agriculture, which is also the general lifestyle of many people in the Solomon Islands (Pacific Islands Forum Secretariat 2012).

With a limited natural resource base, fragile biodiversity and ecosystems, and few development alternatives in many of the SIDS, the loss of agrobiodiversity and ecosystem functions is a potentially serious constraint to their sustainable development.

Moving Forward

Lasting food security – a food production system that is resilient to environmental and economic shocks – requires a holistic approach (Boelee 2011; UNEP 2012a) and should include efforts to conserve existing biodiversity and restore degraded ecosystems. As stressed in the recent Japanese Satoyama-Satoumi Assessment[32], the conservation and enrichment of traditional polycultural rural agricultural and coastal ecosystems is seen as one of the best options for achieving sustainability on islands, and SIDS could consider the assessment as a basis for conserving agrobiodiversity and ecosystem functions.

Boelee (2011) and (UNEP 2012a) highlighted several options for restoring and maintaining biodiversity and ecosystem functions for agriculture, which SIDS could choose to adapt according to their circumstances. These options include improved soil management practices, integrated nutrient management, integrated pest management, agroforestry practices, integrated livestock management, improving and maintaining the diversity of genetic resources, and implementing a landscape approach.

Implementing the above measures, however, requires support for many of the largely subsistence SIDS farmers. It also requires more research to help SIDS maximize the opportunities associated with their wealth of genetic resources in the context of food security and livelihoods. An opportunity for SIDS to acquire relevant knowledge is through the work on agrobiodiversity of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Additionally, the Secretariat of the Pacific Community (SPC) is taking a leading role in the conservation of genetic resources in the Pacific SIDS through the Centre for Pacific Crops and Trees (CePaCT)[33], and this type of initiative could be replicated across the SIDS.

Restoring agrobiodiversity in SIDS presents an excellent opportunity for transitioning to a green economy that takes into consideration the sustainable development priorities and economic and social conditions of individual SIDS. This transitioning may, however, require introducing specific policies and measures geared towards institutional reform, sustainable financing and incentives, investment in technology, and awareness raising. As increasingly shown in the literature, opportunities for a green economy and

Credit: Shutterstock/162794027

32 See: http://archive.ias.unu.edu/sub_page.aspx?catID=1043&ddlID=1042
33 See http://www.spc.int/lrd/the-centre-for-pacific-crops-and-trees-cepact

achieving sustainability need not necessarily take the form of intensive agriculture. Instead, the broadening and deepening of initiatives that promote small-scale eco-sensitive food production may avert some of the problems associated with the loss of agrobiodiversity and ecosystem functions and help transition to a green economy (UNEP 2012b and references therein).

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Issue 008: Overfishing and Potential Collapse of Inshore Marine Ecosystems

Current Situation

The world's coastal and marine ecosystems are under increasing pressures from human activities, among which are increased coastal development, expansion of capture fisheries and fish farming, increased pollution from urban areas and agricultural and industrial activities, and rising demands on coastal resources from global markets and urbanization (UNEP 2012 and references therein). Compounding these threats are marine invasive species and the accelerating impacts of global climate change such as sea level rise and ocean acidification as well as warming seas, which are increasingly becoming evident in marine ecosystems. However, a number of studies show that overfishing outweighs all other human impacts on marine ecosystems and their functioning[34], and has led to "trophic cascades" and the disappearance or "ecological extinction" of many ecologically, economically, and nutritionally important species (Jackson and others 2001; Myers and Worm 2003; Springer and others 2003; Steneck 2012). Further, the negative synergies between overfishing and other threats could lead to the collapse of inshore marine ecosystems (Pauly and others 2005; Roff and others 2012).

Overfishing and its impact on inshore marine ecosystems are of particular concern in SIDS. This is well illustrated in coral reefs, which provide numerous ecosystem services including food provisioning and disaster risk reduction. Many of the reefs in SIDS are declining, as shown in the World Resource Institute (WRI) report "Reefs at Risk Revisited" (Burke and others 2011). According to this study, several of the coral reefs in the Pacific and Indian Oceans that were previously classified as being at low threat are now classified as threatened. This is ascribed to an 80 per cent increase in the threat from overfishing and destructive fishing from 1998 levels.

Unfortunately, little action has been taken to manage the impacts of overfishing on the highly biodiverse inshore marine habitats and species that underpin ecological sustainability

34 See for example Overfishing – Emptying our Seas (2008) at http://www.greenpeace.org.uk/oceans/problems/overfishing-emptying-our-seas and Overfishing: Oceans are Dying (2010) at http://www.oceansentry.org/en/2557-sobrepesca-muerte-de-los-oceanos.html

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as well as food and livelihood security in SIDS. One of the reasons for this is limited data and knowledge on the extent to which inshore fish populations have been altered from their pre-exploitation state, and shortage of competent and appropriately skilled fisheries managers (Gillet and Cartwright 2010). These are challenges that need to be addressed. The demise of inshore ecosystems and fish stocks is encouraging the offshore displacement of fishing fleets (Gillet and Cartwright 2010), which in SIDS are usually small-scale or artisanal and lack proper equipment and technology. However, there is limited knowledge about the possible impacts of fishing on offshore ecosystems. Without adequate information and proper management, offshore ecosystems are likely to suffer the same fate in the near future.

Importance and Relevance to SIDS' Sustainable Development

That SIDS have an inherent and disproportionate dependence on inshore ecosystems and fisheries resources is indisputable. Fish is a major source of protein for SIDS people, making up to 50 per cent of their total animal protein intake (FAO 2012). This has important implications for the problem of undernourishment, which is a major issue confronting many SIDS. Nearly 17 per cent of SIDS population overall and up to 45 per cent in Haiti were undernourished in 2010 - 2012 (FAO and others 2012). With growing human populations and rising cost of livestock products, it is expected that the demand for fish will keep increasing. Fishing is also important for livelihoods, including for women, in many in SIDS. It accounts for 10 per cent of GDP and over 50 per cent of exports in some Islands (Gillett 2011).

The degradation of inshore ecosystems will have other far-reaching effects such as reducing their resilience to climate change impacts. Importantly for SIDS, coastal areas, communities, and infrastructure are becoming more vulnerable to extreme events as a consequence of the reduction in the coastal protective function of these ecosystems. For instance, the observed erosion in some sites in the Seychelles was attributed to a decrease in the extent of coral reefs, which is set to accelerate in the next decade (Sheppard and others 2005). Of the 108 countries and territories covered in "Reefs at Risk Revisited" (Burke and others 2011), the most reef-dependent for coastal protection were mainly small island states, many located in the Pacific and the Caribbean. Further, of the 27 countries and territories identified as highly vulnerable to coral reef degradation and loss, 19 are small island states, with Comoros, Fiji, Grenada, Haiti, Kiribati, and Vanuatu the most vulnerable because of limited capacity to adapt. In addition, the collapse of inshore ecosystems and loss of their services could severely disrupt other important economic activities such as tourism.

Moving Forward

There are many options for addressing overfishing and its impacts on inshore ecosystems. These include reducing unsustainable fishing, for example, by addressing its underlying social and economic drivers, reducing excessive fishing capacity, halting destructive fishing practices, removing subsidies that promotes unsustainable fishing, putting in place governance and enforcement structures that enforce adherence to maximum sustainable yield or other management objectives; involving stakeholders in fisheries management (for example, community-based co-management approach to small scale fisheries[35]); and establishing networks of marine protected areas. Authors such as Worm and others (2009) have also suggested harmonizing fishing laws across countries to prevent the spread of unsustainable fishing practices from industrialized countries to developing countries where legislation may be less stringent.

However, for these measures to be effective, they must form part of a wider integrated programme to address other pressures on coastal ecosystems, including from land, and to build resilience to climate change. The existing FAO Code of Conduct for Responsible Fisheries including ecosystem based fisheries management, provides a strong framework, but resources and incentives will be required for implementation at local, national, and regional levels. Additional research will be also needed on the current impact of degradation on inshore fisheries and the potential impact of fishing on offshore ecosystems.

Credit: Shutterstock/68056723

35 In co-management, the responsibility for management of the resources is shared between the government and resource users

Probably, the most important actions for promoting healthy ecosystems could be taken at the local and national levels, which will depend on efforts by local governments, community groups, environmental organizations, the private sector, and others. One such approach that is gaining momentum is the locally-managed marine area (LMMA)[36] network that is being adopted by Pacific SIDS. Some believe that certain characteristics of LMMAs – local ownership, use and/or control as well as adoption of traditional tenure and management practices (in some areas) – makes them very effective for managing marine ecosystems (Govan 2009 and references therein). However, this type of effort needs cooperation and collaboration at the national and regional levels for the purpose of sharing best practices and ensuring effective representation at regional and global fora.

36 An LMMA is an area of nearshore waters and its associated coastal and marine resources that is largely or wholly managed at a local level by the coastal communities, land-owners, partner organizations, and/or collaborative government representatives who are based in the immediate area. See for example: http://www.lmmanetwork.org/home

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Sustainable Use of Natural Resources

Issue 009: Degradation and Scarcity of Freshwater Resources

Current Situation

Freshwater resources are becoming increasingly scarce globally and more so in small islands[37]. Many SIDS face constraints to effective management of freshwater resources that are common in developing countries such as inadequate technical capacity and lack of financial resources. However, certain unique features of SIDS such as limited surface area, greater sensitivity to natural disasters, and highly permeable aquifers in close proximity to seawater, render their freshwater resources even more vulnerable (White and Falkland 2010; UNEP 2012a; Thaman 2013). Among the multitude of natural and anthropogenic threats to freshwater quality and availability in small islands are reduced catchment recharge, natural disasters, poor sanitation, contamination by human and livestock wastes, deforestation (including of tropical montane cloud forests), pollution from industrial and agricultural activities, losses from storage and delivery systems, over-abstraction, sand and gravel mining from freshwater source areas, saline intrusion due to over-extraction and rising sea level, and deposition of air-borne contaminants from local and distant sources. Further, increasing population as well as changing climate and associated impacts including sea level rise and increasing frequency of extreme events such as floods and droughts are set to worsen the situation (UNEP 2012a; IPCC 2014).

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Some SIDS are already experiencing varying degrees of water-related challenges. The 2011 drought in Tuvalu, for instance, led to a declaration of a state of emergency and water rationing on Funafuti and Nukulaelae atolls for several months[38]. Mauritius, whose primary source of freshwater is rainfall, experienced an 8 per cent decrease in precipitation along with more frequent and severe droughts between 1905 and 2007. This is made worse by the island's topography and hydro-geological characteristics that do not allow for maximum collection of rainwater[39], as in many other SIDS. Mauritius is now projected to become 'water-stressed' by 2025. Similarly, Comoros is projected to become a 'water-scarce' country by the same year because of the threat of saline intrusion into groundwater (UNEP 2012a). In the Bahamas, freshwater has to be brought to the main island (New Providence) from its other islands, mainly Andros (Ratter and Holdschlag 2012). The water situation in the SIDS is clearly depicted by their status with respect to the Millennium Development Goal (MDG) of improving access to safe drinking water, which shows that only the Caribbean has made good progress (UN 2013). According to the 2013 Pacific region MDGs tracking report, only six of the 14 countries are on track to meet the region's target (PIFS 2013), while the AIMS region is lagging even further behind. In fact, some countries, including Comoros, Maldives, and Samoa are showing a reverse trend (UN 2010).

Importance and Relevance to SIDS' Sustainable Development

Continued degradation of freshwater sources and increased scarcity will have far-reaching impacts on health, food security, and overall sustainable development in SIDS. It is believed that water-related stresses jeopardize the continued human habitation of some islands, particularly the low-lying atolls (Terry and Falkland 2009; Chui and Terry 2012), which depend on freshwater lenses and rainfall as their main water source. These lenses are the most threatened aquifer systems in the world because of natural and anthropogenic pressures (White and Falkland 2010). According to the 2011 UN-OHRLLS report, poor water quality and limited water quantity account for many health hazards in SIDS (UN-OHRLLS 2011) For instance, the primary cause of 6 per cent of deaths in Papua New Guinea was attributed to diarrhoea, which is often related to poor water quality (WHO 2009). Furthermore, adequate freshwater is important for the continued growth of the tourism, agriculture and other sectors of the SIDS economy.

Moving Forward

A starting point is to reduce the anthropogenic degradation and loss of freshwater resources through technical measures such as increasing the availability and efficiency of wastewater treatment facilities, encouraging the reuse and recycling of wastewater, reducing chemical contamination from agricultural chemicals by controlling their use, reducing deforestation, reducing losses from storage and delivery systems through regular maintenance, and discouraging over-abstraction. As an alternative to costly wastewater treatment facilities, SIDS can consider low-cost options such as artificial wetlands. This has been implemented in some islands, for example, Saint Lucia in the Caribbean through the Integrated Watershed and Coastal Areas Management Project[40]

37 Freshwater resources in SIDS are variable. While islands like Papua New Guinea have abundant freshwater resources, some islands including Tuvalu, Nauru, Niue, Kiribati, Tonga and Marshall Islands have no significant freshwater resources.

38 http://www.pacificdisaster.net/pdnadmin/data/original/SOPAC_2011_PR38.pdf

39 https://www.undp-aap.org/sites/undp-aap.org/files/FACT%20SHEET%20SEC.pdf

40 http://iwlearn.net/iw-projects/1254

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Another measure for increasing water availability is rainwater harvesting, which is now mandated in some islands, for example, the US Virgin Islands and Bermuda, where it is now compulsory for all new buildings to harvest enough rainwater to meet the needs of their residents (UNEP 2012a). Rainwater harvesting is also being practised in the Turks and Caicos Islands[41].

Although expensive due to its high energy demand, desalination and abstraction of water from deep aquifers are also measures for increasing the availability of good quality water. However, building synergies between the water and energy sectors could help in reducing energy costs. It has been demonstrated, for instance, that desalination can be carried out using renewable energy (Ghermandi and Messalem 2009; IEA-ETSAP and IRENA 2012).

Beyond technical measures, improved assessment, management, and governance of available resources is critical for sustainability. White and Falkland (2010) stated that despite their vulnerability, Pacific island countries do not know the full extent and quality of their water resources – information that is needed for sustainable management of these resources. This calls for a comprehensive assessment that can guide effective management and governance to safeguard watershed areas and groundwater resources.

New knowledge about water-land interactions has important implications for how water and land resources are managed. It suggests that the current paradigm, in which water and land are managed independently, is obsolete (UNEP 2012b) and argues for a shift to the management of water and land in an integrated manner. This will represent a 'win-win' situation by allowing SIDS to gain greater benefits from both its water and land resources. Along this line, SIDS should adopt integrated land and water resources management, which takes a holistic, ecosystem approach to satisfying competing needs for these resources.

41 http://www.unep.or.jp/ietc/publications/techpublications/techpub-8c/rooftop.asp

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Issue 010: Coastal Squeeze and Loss of Associated Ecosystem Services

Current Situation

SIDS are characterized by their relatively small land masses and high population densities[42]. According to the Integrated Island Database (IIDAB)[43], the average population density of all SIDS is estimated at 391.3 persons per square kilometre of land area (compared to the world average of 50 persons per square kilometre), with a total population of approximately 1.3 billion in 2010[44]. These features mean that all available land must be used in an optimal. This includes coastal areas, which in many of the SIDS support major socio-economic activities. For example, 50 per cent of Jamaica's economic assets including port facilities and tourism infrastructure are located in its coastal areas (Richards 2008) while most of the population of the Seychelles along with its main economic activities are concentrated in the coastal plain[45]. Furthermore, for many of the SIDS, the coastal areas support important ecosystems such as coastal littoral forests, mangrove forests, coral reefs, seagrass beds, estuaries, beaches, and coastal plains.

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Human utilization of the coast increased dramatically during the 20th century and this trend is set to continue globally. These growing development pressures as well as rapidly increasing populations are accelerating the conversion of coastal littoral and mangrove forests and wetlands to village, urban, industrial, tourism, agricultural, aquacultural and other uses. This is aggravated by unsustainable extraction of biomass for a variety of uses such as for firewood and construction. Many coastal areas have experienced the total removal of vegetation or the selective removal of many of the more culturally valuable species (Thaman 2008). Human development pressures on the one hand coupled with sea level rise and associated impacts such as erosion on the other create the phenomenon of 'coastal squeeze,'[46] and consequently the loss of valuable ecosystem services including carbon sequestration or blue carbon[47]. Although not a new phenomenon in SIDS, the intensification of severe storms and expected increase in sea level rise is set to exacerbate coastal squeeze. Recent IPCC reports indicate that sea level rise together with extreme events including swell waves and storms surges would result in coastal inundation and erosion in the SIDS[48] (IPCC 2012; 2014) thereby increasing the threat of coastal squeeze (CBD 2010).

Importance and Relevance to SIDS' Sustainable Development

Coastal littoral and mangrove forests are important carbon sinks and critical habitats for a wide diversity of ecologically, culturally, and economically important plants and animals. For some of the world's most threatened animals such as sea turtles and certain species of seabirds and land crabs, coastal littoral forests may be the only major remaining habitats and nesting areas (Mazaris and others 2009; Thaman and others 2012). Other important functions served by these forests include filtering of silt and pollutants, and defence against sea level rise and extreme climatic events, which increasingly threaten coastal communities.

These coastal ecosystems are central for sustainable development in SIDS given the high dependence of island

42 Some SIDS, including Suriname and Guyana, have low population densities (3.4 and 4 persons per sq km respectively). Singapore has the highest population density among the SIDS of 7252.4 persons per sq km

43 http://www.island-database.uni-hamburg.de/. Similar data from the World Bank at http://data.worldbank.org/indicator/EN.POP.DNST/countries/S2-S4-1W?display=default

44 Data based on official 2010 figures. It should be noted that some countries do not have official figures for 2010; hence this estimate includes a few earlier census data.

45 See SEYCHELLES and the United Nations Framework Convention on Climate Change at http://unfccc.int/resource/ccsites/seychell/backgrnd/index.htm

46 Coastal squeeze *is the term used to describe what happens to coastal habitats that are trapped between a fixed landward boundary, such as a sea wall and rising sea levels and/or increased storminess. The habitat is effectively 'squeezed' between the two forces and diminishes in quantity and or quality.* See http://www.solentpedia.info/our_changing_coast/coastal_squeeze/ and http://www.cbd.int/gbo3/?pub=6667&section=6709

47 Blue carbon refers to the carbon captured by oceans and coastal ecosystems including mangroves, seagrasses, and salt marshes.

48 The report, however, stated that the impact of sea level rise on shoreline erosion is masked by the impact of human activities in many of the studies assessed.

populations on the services provided for socio-economic development, livelihoods, and food security. For many small island communities, especially on atolls, coastal littoral and mangrove forests are the only forests that exist and that harbour the majority of plants available for livelihood security. According to Gilman and others (2006), the annual economic value of the goods and services provided by mangrove ecosystems of the Pacific islands is estimated at between USD200,000 and USD900,000 per hectare.

The reduction in the available land area suitable for settlement and infrastructural development due to coastal squeeze is especially of concern in some volcanic islands such as Montserrat, Samoa, Mariana, and the Cook Islands. The particular steep morphology in some parts of these islands renders them unsuitable for human settlement. Hence, a further reduction in suitable land area due to coastal squeeze will be a major obstacle for sustainable development.

Moving Forward

Although a range of measures exists for mitigating the destruction of coastal littoral and mangrove forests, they might be difficult to implement especially when land availability is limited. Hence, efforts should focus on the sustainable use of these resources and, where possible, restoration and reforestation of degraded forests. SIDS could also adopt ecosystem-based integrated development strategies that bring together the cultural, environmental, and socio-economic interests of the State and the community, for example, Integrated Coastal Zone Management (ICZM). Although ICZM is not a new concept, it is relatively recent in some SIDS and its implementation can be fraught with challenges because of SIDS' unique characteristics (Calado and others 2007). Nevertheless, efforts should be accelerated to implement ICZM through increased cooperation and capacity building among professionals and governments, both nationally and regionally and with adequate international support. As called for in the 2011 UN-OHRLLS report, there is a need to *"establish and strengthen national administrative and legislative capacity for developing and implementing integrated coastal zone management plans and strategies…"* in SIDS. SIDS could learn from the recently concluded AGEDI blue carbon demonstration project which assess the services provided by mangroves, salt marsh and sea grass, and identified suitable options for incorporating consideration of these ecosystems and their services into the State's policy and governance framework, as well as established financial support for conserving blue carbon (AGEDI 2013).

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Many SIDS have already developed and implemented strategies for the sustainable use and management of coastal areas. In Mauritius, for instance, a comprehensive policy, legal, and management framework for the protection and management of Environmentally Sensitive Areas as well as an ICZM framework have been adopted (Seewoobaduth 2009). Another example is Barbados' comprehensive Coastal Zone Management Plan, which dates back to 1998 (Barter and others 2008). Efforts must be made to ensure that such policies, laws, and frameworks are effectively implemented and enforced.

Efforts in protecting coastal vegetation can be motivated by linking it with climate- change adaptation and increasing awareness, for example, through publications like the SPREP report on Ecosystem-based Adaptation in Choiseul Province in the Solomon Islands[49].

49 See http://www.preventionweb.net/english/professional/publications/v.php?id=34335

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Issue 011: Reaching the Limit of Land Capacity

Current Situation

Many SIDS are characterized by limited land resources on the one hand and increasing demands for these resources by a growing population and socio-economic development on the other[50]. Furthermore, the morphological characteristics of some SIDS including soil type, relief, and geologically hazardous areas render some of the land area unsuitable for socio-economic activities. Hence, the limited amount of suitable land available is under intense pressures from multiple and competing uses. Among these are agriculture, residential and infrastructural developments, industrial use, tourism, and waste disposal. This is aggravated by other drivers including unsustainable land-management and land-use practices, land tenure issues, insufficient institutional capacities, poor legislation, lack of monitoring and enforcement, limited collaboration among state, private sectors and civil society (Sebastien, 2008), and climate change and extreme events. The recent IPCC SREX Report (IPCC 2012) and Assessment Report 5 (IPCC, 2014) indicate that extreme events such as floods and sea level rise could result in inundation and erosion in SIDS, resulting in further reduction in land availability.

Credit: Shutterstock/137911238

The ultimate consequence of these competing demands and other drivers is the accelerated degradation[51] of the available land in many SIDS, as well as the deterioration in water quality, particularly in coastal and marine areas. For example, as a result of mainly degradation only 20 per cent of the 27,720 km^2 of land in Haiti is suitable for agriculture (Williams 2011) and about 50 per cent of the country's topsoil has been washed away (ISRIC 2008). As stated by the Partnership Initiative on Land Degradation and Sustainable Land Management led by the Global Mechanism for the United Nations Convention to Combat Desertification (GM/UNCCD), "*the major long-term land management issue in SIDS is the degradation of the limited land area...*"[52].

An emerging concern is that these cumulative pressures may be leading the affected SIDS to a point where the limit of their land carrying capacity is being reached, that is, a situation whereby the available ecosystem services may no longer be able to support future human population and socio-economic activities. Suggestions to address these issues have been made, for example, an alternative food production system for the Pacific and the likely relocation of some coastal settlements (Nunn 2013).

Importance and Relevance to SIDS' Sustainable Development

Land is one of the most valuable natural resources of small islands and is closely linked to freshwater, another important resource. The degradation of these resources could pose serious constraints on the sustainable development of the affected SIDS. There may be tipping points where the degradation of vital land and water resources rapidly accelerates and threaten island habitability. This type of situation could have severe socio-economic consequences, especially given that some of the land-use activities are sometimes carried out without adequate consultation with relevant stakeholders[53].

Moving Forward

Degradation of agricultural lands can be managed through restoration projects such as those being implemented by the International Fund for Agricultural Development and the World Food Programme in Haiti[54]. However, such projects could be capital-intensive and may therefore require international support as seen in Haiti.

To tackle the potential problem of exceeding land carrying capacity, it is important that available land resources are used judiciously. Along this line, National Development Plans should be based on an integrated approach, which takes into consideration all stakeholders, key socio-

50 The average SIDS is fairly densely populated but not all SIDS are faced with limited land challenges. For example, whilst Singapore has total land area of approximately 710 sq km and a population of 7252.4 people per sq km, Papua New Guinea has a total land area of approximately 462,840 sq km and a population density of 16 people per sq km.

51 Land degradation is the reduction in the quality of soils or land resulting in a decrease in the ability of the soil to produce food, sustain livelihoods, and provide other ecosystem goods and services.

52 http://www.pnuma.org/sids_ing/documents/basic%20reports/Partnership%20on%20Land%20Degradation%20and%20Sustainable%20Land%20Manag..pdf

53 For example, according to Reuters, the population of Haiti's south coast island of Ile-à-Vache was not consulted before the island was identified for tourism investment. http://www.reuters.com/article/2014/04/06/us-haiti-tourism-idUSBREA3506V20140406

54 See http://sids-l.iisd.org/news/ifad-wfp-small-scale-irrigation-project-combats-land-degradation-in-haiti/

economic indicators such as poverty, health, urbanization, critical infrastructure, agriculture, and human settlements. Furthermore, economic, social, and environmental planning should be based on estimates of human carrying capacity on each island, considering both normal environmental variability and climate change. Agenda 21[55] of the United Nations recognized the need for integrated planning and management of land resources, stating that it should "*facilitate the allocation of land to the uses that provide the greatest sustainable benefits*". Some SIDS have been working towards developing land-use policies that embrace this approach. For example, Trinidad and Tobago aims to meet its population's land-use requirements by developing a new National Physical Development Plan that focuses on zoning of activities relating to residential, industrial, and agricultural areas and ensuring that land-use planning takes into consideration hazards and environmental impact assessments (Ministry of Planning and the Economy 2012).

Since there are trade-offs between land carrying capacity and lifestyle (Daily and Ehrlich 1992), embracing a more sustainable consumption and production pattern can increase carrying capacity. Studies of carrying capacity can support a conscious effort to build community resilience, restore the resource base, and safeguard or augment land and water resources. SIDS may also need support to strengthen their physical planning and land management capabilities. Regional mechanisms such as the Partnership Initiative on Sustainable Land Management in Caribbean SIDS (PILSM)[56] could be established and strengthened across all SIDS.

55 http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

56 http://cnirdregional.org/pislm/; http://www.pnuma.org/sids_ing/documents/basic%20reports/Partnership%20on%20Land%20Degradation%20and%20Sustainable%20Land%20Manag..pdf

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Issue 012: Harnessing Renewable Energy Opportunities

Current Situation

Most SIDS depend on imported fossil fuels to meet their energy needs. On average, more than 90 per cent of the energy used by SIDS comes from oil imports, with energy consumption accounting for the largest claim on foreign exchange earnings (UN DESA 2010). This is causing a severe drain on the limited financial resources of SIDS. According to Walker-Leigh (2012), *"fuel import bills now represent up to 20 per cent of annual imports of 34 of the 38 small island developing states (SIDS)— between 5 per cent to 20 per cent of their GDPs—and even up to 15 per cent of the total import bills of many of the European Union's 286 islands"*. Another source puts the foreign exchange earnings spent on fossil fuel at above 30 per cent for all SIDS combined[57]. To put into a clearer perspective, all island states spend more than USD90 million each day on more than 900,000 barrels of oil, assuming a price of USD100 per barrel (Garcia and Meisen 2008). The Prime Minister of the Cook Islands stated in 2012 that *"the island spent USD15 million or 15 per cent of its gross domestic product (GDP) on energy imports in 2011, with electricity costing USD2.50 per unit—one of the highest costs per unit in the world[58]"*.

With the realization of the negative impact of the above trend on the one hand, and their endowment with alternative and renewable energy (RE) sources such as biomass, wind, sun, ocean, wave, and hydro and geothermal assets on the other, SIDS are now increasingly adopting RE targets and policies (IRENA 2014). In fact, a number of SIDS already have initiatives aimed at developing RE, for example, Haiti[59], Mauritius[60], Seychelles[61], Comoros[62], Cape

57 See SIDS DOCK briefing note, http://www.gov.gd/egov/pdf/SIDS_DOCK_doc.pdf

58 Presentation by the Prime Minister of the Cook Islands at the May, 2012 High-Level Conference on Achieving Sustainable Energy for All (SE4All) in Small Island Developing States (SIDS), and the Rio+20 Informal Ministerial Meeting, Barbados. See http://sidsdock.org/2012/05

59 http://www.geni.org/globalenergy/library/technical-articles/generation/solar/pv-tech.org/nrg-energy-completes-first-two-solar-energy-projects/index.shtml

60 http://cleantechnica.com/2013/08/15/mauritius-signs-deals-worth-65-million-to-add-renewable-energy-capacity/

61 http://cleantechnica.com/2013/06/18/first-renewable-energy-project-seychelles-wind-farm/

62 http://www.afdb.org/en/news-and-events/article/afdb-provides-us-20-1-million-to-support-clean-energy-in-the-comoros-12255/

Verde[63], Dominican Republic[64], and Trinidad and Tobago[65]. Nevertheless, many argue that RE deployment in SIDS has made little progress and can be implemented at a faster pace (Garcia and Meisen 2008; UN DESA 2010; Singh 2012; Dorman 2014; IRENA 2014). For example, a mere 3 per cent of the energy mix in the Caribbean is renewable energy (UNEP and others 2012).

What then are the barriers to the development of RE in SIDS? Experts have mentioned the following: unavailability of appropriate and indigenous technology, lack of appropriate policy frameworks, weak institutional and legal frameworks, lack of technical capacity, inadequate access to predictable low-cost financial resources, a poor science base geared towards RE development, and limited economy of scale for small and remote markets (Binger 2009; Singh 2012; UNEP and others 2012; IRENA 2014).

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Importance and relevance to SIDS' Sustainable Development

RE deployment offers considerable opportunities for SIDS to reduce their overall fossil fuel consumption and dependence on imported fuel, which is a major source of vulnerability to external economic shocks and trade imbalances. This would also improve their energy security while moving towards clean economic growth and preventing the lock-in of conventional carbon-intensive energy sources.

At present, a large fraction of the population in SIDS, especially in rural areas, do not have access to electricity, as is the case for 70 per cent of the people in the Pacific Islands (Dornan 2014). Accelerated deployment of RE offers an opportunity to address this problem and significantly improve the socio-economic wellbeing of these people through job creation and fostering of economic growth. This would also contribute towards attaining the Millennium Development Goals on extreme poverty and hunger eradication (MDG 1).

In terms of climate change, attention has always focused on adaptation because of SIDS' high vulnerability to the impacts of a changing climate. However, deployment of RE offers an opportunity for SIDS to contribute to climate change mitigation by reducing their carbon dioxide emissions (which have been on the rise by an average annual rate of 2.3 per cent[66]).

Moving Forward

How can the barriers to harnessing RE opportunities in SIDS be overcome? According to some commentators (for example, Singh 2012; UNEP and others 2012), this will require developing and implementing SIDS-appropriate measures and strategies including policy and legislation reform to address the current lack of an appropriate legislative framework to meet policy objectives; shifting of subsidies and investments from carbon-intensive energy sources to RE; using taxes as an incentive for investment in RE, for example, through tax relief and exemptions; and establishing coordinating mechanisms that facilitate exchange of information and experiences and that advocate on behalf of SIDS. The Governments of SIDS will need to play an important role in terms of policy, institutional, and regulatory interventions. These measures should also apply to energy-use efficiency and energy use in the transportation sector.

Implementing these measures will require cooperation and coordination among SIDS and with the international community, particularly for research and development efforts and for developing region-wide strategies such as collective purchasing and financing. Investments in energy-efficient measures in buildings and firms, as successfully achieved by the Energy Service Companies (ESCOs) in Europe and the United States of America, represent major opportunities for small islands (Dornan 2009; Steinberger and others 2009). Public-private partnerships could help to acquire the type of investment needed for RE deployment.

The current motivation among SIDS for deployment of RE should be strengthened, and successful initiatives evaluated and adapted where applicable. Examples of such initiatives include the use of sugarcane and its baggasse in Mauritius, which provides approximately 17 per cent of the island's energy requirements (Ramjeawon 2008); the national energy policies of Fiji that promote the production of biofuels through planting on degraded lands that have resulted in around 65 per cent of the country's electricity requirements being met from RE sources (Fiji Department of Energy 2010); the subsidy programmes in Antigua, Barbados, and Mauritius that encourage the use of solar

63 http://www.climateactionprogramme.org/news/eu_supporting_renewable_energy_in_cape_verde/

64 http://www.edinenergy.org/dominica.html

65 http://www.news.gov.tt/content/trinidad-and-tobago-lead-regional-renewable-energy-research

66 http://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=313&menu=1572

water heaters[67]; the PIGGAREP project, which aims to reduce the production of greenhouse gases in Pacific Island countries through the removal of barriers to the widespread and cost-effective use of feasible RE technologies[68]; and the facilitation provided by SIDS DOCK—the Small Island Developing States Sustainable Energy Initiative[69].

67 See http://cdkn.org/resource/cdkn-inside-story-seizing-the-sunshine-barbados-thriving-solar-water-heater-industry/; http://www.unep.org/newscentre/Default.aspx?DocumentID=2762&ArticleID=10719; and http://www.gov.mu/portal/sites/mid/SolarScheme.htm

68 PIGGAREP - Pacific Islands Greenhouse Gas Abatement Through Renewable Energy: http://www.sprep.org/Pacific-Islands-Greenhouse-Gas-Abatement-through-Renewable-Energy-Project/about-piggarep

69 SIDS DOCK is a SIDS-SIDS sustainable energy initiative with a goal of increasing energy efficiency by 25 per cent relative to a 2005 baseline and to generate a minimum of 50 per cent of electric power from renewable sources and a 20-30 per cent decrease in conventional transportation fuel use by 2033. See http://www.gov.gd/egov/pdf/SIDS_DOCK_doc.pdf

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Issue 013: Balancing the Opportunities and Risks of Exploring SIDS' Unexploited Natural Resource

Current Situation

Although SIDS are generally characterized by limited natural resources they are also custodians of valuable resources including forests, biodiversity, fish stocks and coral reefs. But rising demands, unsustainable exploitation, and ineffective management have resulted in the degradation and/or depletion of many of these resources. The descriptions in this report have highlighted the impact of multiple anthropogenic and natural stressors on SIDS' natural resources, for example, biodiversity (Issues 004, 006, and 007), forest resources (Issues 005, 007, and 010), and fish stocks (Issue 008).

The good news, however, is that many SIDS possess some hitherto unexploited natural resources in terrestrial areas as well as in their Exclusive Economic Zones (EEZs) and in the deep sea. Among these are mineral nodules, potential pharmaceutical products, hydrocarbons, renewable energy resources, and fish stocks. Already, rising demands and economic development, coupled with depletion of conventional resources, are driving the desire to exploit these untouched resources. For example, with the depletion of inshore fish stocks, industrial fishing has spread seaward and to deeper waters in pursuit of new fisheries resources (Watson and Morato 2013). Another example is the exploration and development of deep sea mining for metals and minerals, which is now at an advanced stage in certain areas. In 2011 alone, four new exploration contracts for potential deep-sea mineral extraction were issued by the International Seabed Authority[70]. Plans are also underway to harness the wave, thermal, current and other energy potential of the ocean (UNEP and others 2012).

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Importance and Relevance to SIDS' Sustainable Development

The exploration of these new frontiers of natural resources presents opportunities to meet a broad range of economic and social aspirations in SIDS. Some SIDS are already expanding into these new areas, as seen, for example, by Papua New Guinea, which has embarked on exploratory

70 http://online.wsj.com/news/articles/SB10001424052702303395604577434660065784388

activities for mining of seabed manganese nodules and rare earth elements[71]. These activities, however, come with many challenges. For example, in the case of deep-sea mining, there are legitimate concerns with respect to both current understanding of the different ecosystems associated with deep-sea mineral sites, and the potential social, economic, and environmental consequences of exploration activities. Experts have long cautioned that deep-sea mining could have disastrous long-term consequences for the marine environment, including unique deep-sea habitats and species[72]. Similar concerns exist for tapping the ocean for energy and expanding fishing seawards and deeper (Bailey and others 2009; Boerlert and others 2010; Saidur and others 2011; Norse and others 2012).

The potential impact of exploring land and ocean ecosystems be it for mining, fishing, or energy development, as appropriate, is of concern to SIDS people who are highly dependent on subsistence and commercial agriculture and fishing as well as many who depend on sea-based tourism. Experience has shown that poor environmental management can result in extensive ecosystem destruction and permanent damage to food security and livelihoods.

Moreover, the lack of experience, expertise, human resources, tools, and appropriate institutional frameworks to take full advantage of these opportunities and to comprehensively assess and monitor their potential environmental impacts will continue to constrain the ability of most SIDS to expand into these new frontiers. Added to this is the concern about ensuring an equitable distribution of accrued revenues amongst the population of the affected SIDS.

Moving Forward

The foregoing indicates that SIDS could place themselves at the forefront of relatively new industries and that they have the opportunity to set a precedent for the sustainable exploration of these resources.

Embarking on these new ventures will however come with diverse responsibilities including ensuring that the resources are exploited in an optimal and sustainable manner for the benefit of all stakeholders, identifying potential risks and benefits, protecting the intellectual property rights of genetic and other resources, biodiversity conservation and environmental protection, and providing an appropriate institutional framework for sustainable natural resource management. It also places an obligation on SIDS to prepare and periodically update their resource inventories, which can be valuable tools for management decision-making.

It is necessary, therefore, to conduct detailed scientific resource assessments to aid the development of robust guidelines and frameworks for sustainable exploitation and management. Along this line, it should be noted that the International Seabed Authority is developing legislative and regulatory provisions for environmental management of deep-seabed mining including within national jurisdictions (ISA 2013).

SIDS should consider internationally accepted best practices in environmental management, which include legal and policy measures that underpin environmental safeguards (such as environmental impact assessments) as a prerequisite for the granting of rights to companies to engage in exploration and development (for example, deep-sea mining) as well as measures to support effective environmental monitoring and the mitigation of environmental damage.

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In developing polices, SIDS would need to ensure consistency with pre-existing initiatives, laws, policies, and guidelines, including the UN Convention on the Law of the Sea (UNCLOS), the Noumea Convention (SPREP), the Madang Guidelines, the Pacific Island Regional Ocean Policy (PIROP), the Convention on Biodiversity (CBD), the Pacific Plan, and the International Seabed Authority's Mining Code. There are also lessons to be learned from onshore mining and offshore oil and gas extraction, such as the prevention of physical habitat destruction and biodiversity loss as well as the management of toxic waste.

The precautionary principle must be applied because of the uncertainty surrounding these activities and to avoid repeating previous mistakes. Adaptive management strategies that incorporate new information and knowledge as the industry advances could be adopted. Opportunities should also be provided for all key stakeholders to be involved in decision making. This would also help to ensure equitable distribution of benefits and revenues from exploitation of these new resources.

Developing unexploited natural resources will also require that appropriate capacities (human, technological, etc.) are acquired or strengthened. Furthermore, since issues relating to natural resource exploration and

71 http://www.bbc.com/news/science-environment-27158883

72 http://www.independent.co.uk/news/science/scientists-warn-over-coming-era-of-deep-sea-mining-9134448.html

development may not be confined to national borders or EEZs but have a regional character, SIDS could seek to foster bi- and multi-lateral and regional collaborative relationships for the sustainable exploitation of transboundary natural resources. This collaboration could also serve as a mechanism to support capacity building. In 2011 the Secretariat of the Pacific Community (SPC) commenced a four-year European Union-funded project 'Deep Sea Minerals in the Pacific Islands Region: a Legal and Fiscal Framework for Sustainable Resource Management'[73]. The project aims to strengthen systems of governance and capacity of Pacific Island countries to manage their potential deep-sea mineral resources. SIDS that are not yet affected by deep-sea mining could lend their support to the Pacific SIDS and position themselves to learn and apply the lessons from that region should they themselves embark on deep-sea mining in the future.

73 http://www.spc.int/en/home/216-about-spc-news/546-eu-and-spc-to-cooperate-on-deep-sea-minerals-project.html

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Issue 014: Developing an Ocean-based Green Economy

Current Situation

The need for a transition of current economic systems to a 'green economy' has been a major topic of discussion between many different commentators in recent times, both from the political and scientific fronts (for example, HM Government 2011; Brockington 2012; Jones 2012; Ocampo and others 2012; ten Brink and others 2012; Ulrich 2012; Borel-Saladin and Turok 2013). This need was emphasized in the outcome document of the 2012 United Nations Conference on Sustainable Development (Rio+20)[74], in which world leaders and a broad section of civil society affirmed that a *"green economy in the context of sustainable development and poverty eradication [is] one of the important tools available for achieving sustainable development"*.

But what is a 'green economy'? UNEP defines a green economy as "*one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities".* This definition is amplified further to mean an economy that is "*low carbon, resource efficient and socially inclusive*" (UNEP 2011). The definition further states that it is "*envisaged that in a green economy, growth in income and employment will be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services*".

For most SIDS, transitioning to a 'green economy' largely means greening an ocean-based economy, since most of their population and economic activities are located close to and are associated with the coasts and oceans—hence, the concept of 'developing an ocean-based green economy'. Whilst the transition to a green economy is still in its infancy in SIDS, individual SIDS are interpreting the green economy concept according to their sustainable development priorities and national economic and social conditions (CARICOM 2012). UNEP and others (2012a) indicate that the potential opportunities from a 'green economy' have stirred a great deal of interest amongst many SIDS, especially at a time when the global economy is still recovering from the recent financial crisis.

Importance and Relevance to SIDS' Sustainable Development

How important and relevant is the 'green economy' to the ocean-based economy of SIDS?

Because of the inordinate importance of the ocean to islands, a transition to an ocean-based green economy can assist SIDS in addressing some of their most critical development challenges. With the widespread decline in the ecological health and productivity of coastal ecosystems in SIDS, a thrust towards a 'green economy' can be the turning point for reversing the situation and moving towards sustainable development. This is also particularly important considering that many island countries are approaching the limit of their land carrying capacity and have few viable alternatives. SIDS hold jurisdiction over coastal waters and ocean areas that are several times larger than their land masses. Mauritius, the Maldives, and the Seychelles, for example, have an EEZ to land area ratio of

74 http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf

about 1000 or more[75]. These areas provide opportunities for diverse economic activities including fishing, maritime transport, offshore mining, and tourism.

UNEP and others (2012a) identified five development sectors in SIDS that can be 'greened'. These include fisheries and aquaculture, water, tourism, energy, and solid waste. Another potential candidate for a green economy is the mining sector (UNEP and others 2012b). These reports concluded that a transition to a green economy across these sectors provides a critical pathway to socio-economic development and inclusion, harmonizing conflicting demands, maintaining macro-economic stability, and facilitating job creation while protecting natural resources.

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It must be noted, however, that there are many practical and political challenges to transitioning to an ocean-based green economy, including scarce human and financial resources, limited access to appropriate marine technologies that are adapted to local conditions, inadequate ocean governance, weak cooperation among the SIDS themselves and with other developing countries, lack of political weight in competition for offshore resources, and limited technical and capital resources for asserting and enforcing legislation and governance in sectors such as oil, offshore mining, and fishing.

Moving Forward

UNEP and others (2012a and 2012b) discuss important approaches and solutions that can be adapted by SIDS, including adopting ecosystem-based approaches to fisheries and aquaculture management; adopting comprehensive national tourism policies that promote sustainability; putting in place policies, practices, and integrated water resources management programmes; promoting the adoption of SIDS-appropriate sustainable energy technologies; and developing and enforcing integrated solid waste management plans.

To implement these approaches, it is imperative that enabling conditions are provided to encourage sustainable investment from both the public and private sectors. In this regard, governments have an important role to play by developing the appropriate policies, undertaking the necessary institutional reforms, strengthening collaboration and coordination across agencies and at national and local scales; and facilitating technology transfer and capacity building.

It is also important that risks and opportunities associated with the transition to an ocean-based green economy are scientifically assessed prior to and during implementation. Hence, knowledge on available opportunities and how to avoid negative environmental and socio-economic impacts of this transition will be necessary. Furthermore, awareness raising to increase understanding and guide decision making both at the individual and institutional levels is also very important in making this transition.

The role of regional cooperation in developing an ocean-based green economy cannot be overemphasized. Because many issues related to the ocean, including governance, are not confined to national borders but have a regional/global dimension, it is important for SIDS to foster regional cooperation in developing an ocean-based green economy.

75 http://www.futuredirections.org.au/publications/associate-papers/1641-climate-change-and-the-future-governance-of-the-micro-island-states-of-the-indian-ocean-region.html

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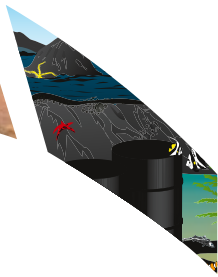


Managing Threats from Chemicals and Waste

Issue 015: Globally-emitted Contaminants Affecting SIDS

Current Situation

Recent scientific findings (for example, Jones 2011; Bouwman and others 2012; Heskett and others 2012; Menzies and others 2013; Bachman and others 2014; Farrington and Takada 2014) have reported the presence of a diverse array of harmful substances in SIDS' ecosystem. Among these are pathogens; microplastics; persistent organic pollutants (POPs), including pharmaceuticals, pesticides, polychlorinated biphenyls, and polycyclic aromatic and other hydrocarbons; and heavy metals, including mercury. The atmosphere is also affected by air pollutants, including particulate matter, dust, organic compounds, ozone, sulphur oxides, and nitrous oxides. Although some of these substances are emitted locally, evidence shows that the global increase in the quantity, range, and use of new and existing chemicals (UNEP 2012a; 2013) coupled with the long-range transport characteristics of many of them could more likely account for their presence in SIDS (for example, Monteil 2008; Zhang and others 2008; Singh and others 2009; Bouwman and others 2012; Garrison and others 2014).

Increasingly, SIDS' environments are being impacted by pollutants that originate from sources thousands of kilometres away. The changing climate and its impacts could further increase the transfer of pollutants by air and water currents, both within SIDS regions and from other continents. A recent IPCC report (IPCC 2014) indicates that small islands are increasingly being affected by impacts originating from distant continents. For example, increased dust levels have been observed in Cape Verde, the eastern Caribbean, and the Mediterranean during periods of drought in the Sahara, while dust from Asia has been transported across the Pacific and Atlantic Oceans. Furthermore, climate-sensitive microbial pathogens have been shown to travel across national boundaries within the Indo-Pacific and Caribbean regions where they have been infecting coral reefs (IPCC 2014 and references therein). A UNEP/Arctic Monitoring and Assessment Programme Expert Group report (UNEP/AMAP 2011) indicated that small islands could become more vulnerable to the impacts of POPs because of the exacerbation of the inundation of contaminated sites and waste management site due to sea level rise and extreme event. Many other scientific studies have shown that climate change will alter the fate, transport, and bioaccumulation of harmful substances, with potential impact on oceanic and coastal communities (for example, Macdonald and others 2003; Schiedek and others 2007; Noyes 2009; Spezzano 2012; Sheahan and others 2013).

Importance and Relevance to SIDS' Sustainable Development

The increasing amounts of these contaminants in SIDS' environments could hamper their sustainable development. A substantial body of evidence has shown that these contaminants have adverse effects on human health, the environment, and living resources. This is of particular concern to SIDS in view of their fragile ecosystems and biodiversity and high dependence on living resources as well as limited capacity to monitor and manage the impacts of these chemicals. Of particular concern are microplastics, which are rapidly emerging pollutants with long-term threats in the marine environment (Moore 2008; Cole and others 2011; Wright and others 2013). Scientific findings indicate that microplastics adsorb and concentrate hydrophobic compounds such as POPs from the surrounding seawater with a concentration factor of up to 1 million (Smedes and others 2009). When ingested, microplastics could transfer POPs to marine organisms, resulting in the subsequent bioaccumulation and biomagnifications of these compounds in the food chain (Wright and others 2013).

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Moving Forward

Since the only long-term solution to reducing the level of contaminants in the environment is by preventing their release (Spezzano 2012), the precautionary principle should be applied in the production and use of chemicals globally. As called for in the UNEP 2012 Global Foresight report, the current practice, in which chemicals are first produced and disseminated and only afterwards assessed more closely for their possible negative impacts, must be replaced by a universal, impartial, comprehensive, and anticipatory approach that seeks to assess the potential human, environmental, and socio-economic impacts of chemicals as well as their production and use before their release (UNEP 2012b). Furthermore, there is a need globally to redesign chemical products as well as their production processes and to minimize the use of harmful substances through approaches such as green chemistry (UNEP 2013).

One of the challenges for many individual SIDS is the lack of capacity to effectively participate in deliberations of the chemical-related Multilateral Environment Agreements (MEAs) — the Basel, Rotterdam, Stockholm, and Waigani Conventions. However, SIDS can cooperate to develop collective mechanisms for exerting influence on the global stage. The important role of regional mechanisms such as the Regional Seas Programme should not be overlooked in facilitating this cooperation. Moreover, joining forces with non-SIDS countries that are affected in a similar manner would also give SIDS a stronger voice.

The need is emerging for further research to identify the sources of these transboundary contaminants and their impacts on ecosystems, food webs, and human health in SIDS. There is also a local dimension to the problem, which requires that SIDS implement adequate chemical management strategies and integrated waste management practices and develops more comprehensive interventions based on existing knowledge.

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Issue 016: Indiscriminate and Increasing Use of Pesticides

Current Situation

Global chemical production, trade, use and disposal are increasingly migrating towards developing countries and countries with economies in transition (UNEP 2012). Among these chemicals are agricultural chemicals, including fertilizers and pesticides, which are among the largest volumes of chemicals used worldwide (UNEP 2012). There are booming pesticide markets in some countries, including many developing countries where agriculture is the biggest economic sector and accounts for the highest releases of chemicals. Moreover, several SIDS also serve as dumping grounds for pesticides that are banned from use in other countries, including those that manufacture them (EJF 2002; Thaman 2003). As a result, there is growing concern over chemical releases associated with increasing economic production in developing countries and those with economies in transition.

A wide array of chemicals are being imported by SIDS[76] and used for domestic and agricultural pest control, as fumigants in plant protection and quarantine operations, and for the control of mosquitoes and other disease vectors. Recent findings suggest an increase in the use of synthetic pesticides in Pacific Island Countries (PICs) (Lazar-Baker and others 2011; Markham 2013), and that inefficient and/or inappropriate pesticide use is impacting the ecosystems

76 http://www.gdrc.org/oceans/sin-problems.html

in this region (Morrison and others 2013). Increasing use of pesticides, including insecticides, herbicides and other biocides, is inflicting collateral damage on human health, ecosystems, and biodiversity. This is likely to get worse in view of the development of widespread pest resistance and the emergence of 'superpests' whose control requires increasingly potent pesticides[77].

A major source of concern is that many SIDS often have no system for accounting for the fate and impacts of these chemicals on human and environmental health because of inadequate legislation for controlling toxic chemicals[78]. Furthermore, many SIDS often have limited capacity to control and manage pesticide use, and management practices, where they exist, are variable. Management of obsolete chemicals also remains a problem because of the lack of capacity and facilities for their treatment and disposal.

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Importance and Relevance to SIDS' Sustainable Development

Many pesticides, such as DDT and dieldrin, are POPs that remain in the environment for extended periods, can be transported over long distances, and bioaccumulate in the food chain. Their indiscriminate and increasing use can have potentially devastating consequences on small island environments, which have fragile ecosystems and biodiversity and close links between the terrestrial, freshwater, and marine environments. With some SIDs having steep topography and narrow coastlines, chemicals often end up in the sea and slowly bioaccumulate in the marine food chain. This could ultimately affect humans when they consume food containing high levels of these compounds. Another major cause for concern is the potentially irreversible loss of endemic and other species and the threat to agriculture and honey production when pollinating insects and honey bees are killed off. Pesticides can also contaminate surface and groundwater resources, which are already limited in quantity and quality in many SIDS.

77 http://www.naturalnews.com/037491_gmo_pesticides_mutations.html# and http://www.newscientist.com/article/dn23688-superpests-are-fighting-back-against-killer-crops.html

78 http://islands.unep.ch/siemb1.htm

Moving Forward

A wide range of instruments and approaches as well as methods and tools are available for promoting sound chemical management (Mörner and others 2002; UNEP 2012). Reducing and eventually eliminating POPs, as mandated by the Stockholm Convention, are actions that provide an opportunity to re-think strategies used in pest and vector control. Sound pesticide management strategies and appropriate actions would help to optimize the contribution of pesticides to agricultural productivity while reducing their adverse impacts. One approach is Integrated Pest Management (IPM)[79], which controls pests through a combination of monitoring and understanding pests, biological control methods (using organic or natural alternatives to synthetic pesticides), and ecosystem management. Hence, in IPM, pest control strategies include a combination of observation, cultural practices, and mechanical and biological control, with targeted pesticide application only when necessary. This type of pest management also promotes an increase in agrobiodiversity, which has a positive effect on food security as well as on ecosystem health. Furthermore, the application of biological control methods represents a foreign exchange cost saving for those SIDS with high pesticide import bills, and could create new employment opportunities.

Effective eco-friendly pesticides are available but their high cost prevents their widespread adoption. An option for overcoming this challenge is to transfer the current subsidies that encourage the use of harmful pesticides to eco-friendly alternatives. Hence, SIDS governments may need to evaluate some of their existing programmes and policies with the aim of establishing sustainable mechanisms. But governments also need to look beyond mere replacement of harmful pesticides with eco-friendly ones to more sustainable alternative practices based on integrated management principles (Mörner and others 2002) such as IPM, as described above.

Participation in pesticide management is required from all key stakeholders such as relevant national and international institutions, NGOs, private sector, and individuals including consumers, who can demand for safer products and services.

An obvious requirement for successful pesticide management is a favourable policy and regulatory environment. Some SIDS have created legal structures and competent authorities for managing chemicals. For instance, the Caribbean has established both regional and national Pesticides and Toxic Chemicals Control Boards to govern the import, licensing, and use of chemicals in agriculture, health, and vector control. Furthermore, it is important that capacity-building is provided to such structures to ensure that they are able to fulfil their functions. These structures could be replicated in other SIDS.

79 http://www.epa.gov/oecaagct/tipm.html and http://www.fao.org/agriculture/crops/core-themes/theme/spi/scpi-home/managing-ecosystems/integrated-pest-management/ipm_what/en/ for detailed explanation of IPM.

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Issue 017: Greening the Waste Sector: Turning Waste to Opportunities in SIDS

Current Situation

As in many other developing countries, waste management is a growing problem in SIDS. According to SIDSnet, management of waste is both a critical and complicated issue for many of the SIDS because of their small land mass and limited availability of other resources[80]. Population growth, socio-economic development, and changes in lifestyle as well as in production and consumption patterns have led to an escalation in the quantity and altered the composition of both solid and liquid wastes in SIDS. Solid waste generation rates are estimated to range from 0.75 to 2.8 kg per capita per day. It is composed of organics (which comprise close to 50 per cent of the waste stream), plastics, paper, metal, textile, and glass. Management of domestic wastewater is also of major concern. According to Veitayaki (2010), only about 10 per cent of the population in the Pacific Islands has sewerage systems and moreover, the wastewater from these systems is not properly managed. Also of concern is the issue of electronic waste (e-waste). E-waste is considered the fastest growing pollution problem globally (Kiddee and others 2013), with a generation rate of about 40 million tonnes per year[81]. Reliable data on the volume of e-waste generated in SIDS are scarce but the growing use of electrical and electronic equipment is leading to an increase in the generation of e-waste, as seen, for example, in the Pacific Island Countries (SPREP 2011).

In many SIDS, the national waste management policies and strategies are still largely focused on end-of-life responses or solutions, and most of the waste collected is disposed of in sanitary landfills. This practice creates various challenges for SIDS because of the potential threats to human, environmental, and ecosystem health as well as the contribution of decomposing garbage to the emission of greenhouse gases. However, there are alternatives for waste management that can make the waste sector more economically, environmentally, and socially sustainable.

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Importance and Relevance to SIDS' Sustainable Development

Waste (including wastewater) disposal takes on even greater proportions in view of SIDS' fragile biodiversity and environment. Furthermore, poor waste management have negative implication for the socioeconomic wellbeing of SIDS' people. But the waste management problem also presents excellent opportunities for greening the economy in SIDS. Technological advances in waste recovery and reuse, in transforming waste materials into valuable products as well as in conversion of waste to energy can provide significant benefits including resource and energy savings, fertilizer and energy production, reduced greenhouse gas emissions, creation of new business and employment opportunities including for the informal sector, and an overall contribution to poverty alleviation in SIDS (UNEP and others 2012). It must be noted, however, that a key driver for turning waste into resources is the recognition of the value in waste and the creation of a market for generated wastes.

But greening the waste sector is not without its challenges, among which are barriers to technology transfer and limited economies of scale in SIDS.

80 http://www.sidsnet.org/waste-management
81 http://www.sciencedaily.com/releases/2010/02/100222081911.htm

Moving Forward

Overall, waste management in SIDS must be addressed as part of a wider strategy to ensure improved wellbeing of its people and environmental sustainability. According to UNEP and others (2012), greening the waste sector in SIDS *"requires a shift from less-preferred waste treatment and disposal methods such as incineration (without energy recovery) and landfilling towards the "three Rs": Reduce, Reuse and Recycle. The strategy is to move upstream in the waste management hierarchy*[82] *based on the internationally recognized approach of Integrated Solid Waste Management"*. Measures to achieve this include developing national integrated solid waste management policies, strategies, and action plans; mobilizing investments for greening the waste sector by adopting cost recovery measures, for example, the polluter pays principle; establishing partnerships with the private sector; providing incentives for waste avoidance; providing public education on the effects of waste; and raising awareness. Options for using wastewater for energy generation and agricultural fertilizer should also be explored. SIDS could also reduce waste generation upstream by limiting imports or mandating that all imported products, equipment, vehicles, etc. are re-exported at the end of their useful life. They could also reduce the quantity of generated waste by imposing a ban on plastic bags and other packaging materials.

SIDS will need more technical and human capacity as well as financial resources to advance systems and processes to green the waste sector. Support is also needed in terms of securing SIDS-appropriate technologies for the different waste streams and for overcoming the challenges of economies of scale. Options to address these needs include embarking on partnerships between governments, the private sector, academic and research institutions, and other relevant stakeholders. In addition, regional cooperation can support capacity building, technology transfer, and joint investment in a central waste management facility, where appropriate.

82 The waste management hierarchy prioritizes waste management practices in a way that results in optimal environmental outcomes. It sets out the preferred order of waste management practices, from most to least preferred, that is: avoid, reduce, reuse, recycle, recover, treat, and dispose.

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Addressing Climate Change and its Impacts

Issue 018: Disproportionate Impact of Climate Change and Sea Level Rise in SIDS

Current Situation

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC 2013) provides scientific evidence that human influence, particularly greenhouse gas emissions, is a dominant factor in global warming and resulting climate change and sea level rise. Even if emissions are stabilized soon, further warming and its effect on climate and sea level are expected to persist beyond the 21st century. According to the AR5, the rate of global mean sea level rise has continued to increase since the early 20th century and will continue beyond the year 2100.

Climate change impacts are associated with both rapid-onset events, such as more frequent and intense storms and coastal flooding, and slow-onset processes such as land degradation, rising sea levels and sea surface temperatures, ocean acidification, changes in the global water cycle, and reduction in snow and ice. Sea level rise is expected to exacerbate coastal erosion, storm surges, and other coastal hazards (Monnereau and Abraham 2013), and lead to salinization of coastal aquifers and agricultural land. There is growing consensus that the magnitude and frequency of many weather- and climate-related hazards will increase as climate warming accelerates, especially in small islands (UN 2010; IPCC 2014).

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Although SIDS themselves emit negligible amounts of greenhouse gases, they face a disproportionately high level of impact from climate change. For example, while the global mean sea level rise is 3.2 mm per year, in the island of Kosrae in the Federated States of Micronesia sea level is rising at a rate of 10 mm per year (Monnereau and Abraham 2013). In the tropical western Pacific, where many small islands are located, the rate of sea level rise was 12 mm per year between 1993 and 2009, that is, about four times the global average (IPCC 2014).

Importance and Relevance to SIDS' Sustainable Development

Climate change and sea level rise are undoubtedly the most pressing threat to the environment and sustainable development of SIDS. Climate change will also compound the effects of several other issues, as highlighted in this report. The principal areas of socio-economic and environmental vulnerability to climate change and associated impacts include tourism, fisheries, agriculture, freshwater, human health, and infrastructure. This vulnerability is magnified in SIDS owing to their relatively small land mass; the concentrations of population, infrastructure, and economic activities in coastal areas; and their high dependence on coastal ecosystems for food and livelihood security and protection from extreme events. Moreover, unresolved problems related to poverty, scarcity of resources, and constrained governance and adaptation raise the susceptibility of SIDS to natural hazards (UNU 2012).

Climate change also poses a major threat to coastal ecosystems on which SIDS depend for food and livelihoods. Most notable are coral reefs, which are already severely degraded by rising sea surface temperatures in all SIDS regions. In the Insular Caribbean, for example, up to 100 per cent of coral reefs in some areas have been affected by bleaching due to thermal stress (Wilkinson and Souter 2008). Climate-related threats are projected to push the proportion of reefs at risk in the Caribbean to 90 per cent in the year 2030, and up to 100 per cent by 2050 (Burke and others 2011). Mangroves are also affected especially by rising sea levels (Waycott and others 2011) and increased erosion. These are worrying trends particularly since the resilience of coral reefs, mangroves, and other coastal habitats is already being compromised by human pressures.

Given the current trajectory of global greenhouse gas emissions, these events will continue to have devastating consequences for the environment and socio-economic development in SIDS. Adaptation to climate change is a priority for SIDS, and socio-economic development must be approached within the context of climate change adaptation. While SIDS are making some progress, measures and responses as well as available budgets remain inadequate in most cases.

Moving Forward

Addressing climate change will require substantial and sustained reductions of global greenhouse gas emissions, over which SIDS have little control. Therefore, the most viable option for SIDS is to take urgent action to adapt to climate change and to mitigate the severity of its impacts. Based on the trajectory of global greenhouse gas emissions, it is imperative that adaptation and improving

the resilience of the people, economy, infrastructure and ecosystems in conjunction with disaster risk reduction strategies and community based approaches become an integral part of comprehensive sustainable development strategies (IPPC 2014). Further, climate change needs to be integrated across all public and private sectors and in coastal zone management frameworks.

A comprehensive package of agreed mitigation, adaptive, technological, and cooperative measures accompanied by early warning systems should be implemented at the earliest possible time. These measures should be based on the specific needs of SIDS and developed using available resources, including local knowledge and traditional skills and technologies. Climate change adaptation strategies derived only from external agendas may lack a SIDS-specific focus, and could result in inappropriate design, wasted resources, or worse, mal-adaptation. The conservation, restoration, and use of coastal habitats in eco-engineering solutions ('green solutions') for coastal protection present a promising strategy for climate change mitigation and adaption and reducing coastal hazards in SIDS (for example, Cheong and others 2013, Duarte and others 2013, Zhang and others 2012). Hence, ecosystem based adaptation should be promoted. These no- or low-regret measures are also attractive because of their cost-effectiveness. Other such options include revamping early warning systems; preventing land reclamation; replenishing beaches; and improving housing, sanitation, and transportation systems.

The SIDS community needs mechanisms for collective representation in global arenas, both for influencing decisions relating to climate change mitigation and for acquiring technical and financial support for adaptation to a problem over which they have little control. Examples of such mechanisms are the Caribbean Community Climate Change Centre, the Memoranda of Understanding between the South Pacific Regional Environmental Programme and the Indian Ocean Commission aimed at strengthening regional cooperation, and the Association of Small Island States.

It is also necessary for the international community to step up efforts to reduce climate change impacts and to provide technical and financial support to SIDS for climate change adaptation, given the high associated cost and the economic circumstances of many SIDS. The current trajectory of greenhouse gas emissions must be changed through the adoption of a legally binding agreement that includes clear and ambitious targets for reduction of greenhouse gas emissions.

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Issue 019: Intensification of Extreme Events; External Shocks; and Increasing Vulnerability of SIDS

Current Situation

The 2012 IPCC report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation", documents an increase in the frequency of heat waves, heavy precipitation, rising wind speed of tropical cyclones, and increasing intensity of droughts (IPCC 2012). Countries affected by extreme events have experienced significant loss of lives, property, and infrastructure as well as billions of dollars in damages (CRED 2013). Moreover, there is a growing pattern of exposure to these events in developing countries (CRED 2013). It is predicted that up to 325 million of extremely poor people will be living in the 49 hazard-prone countries in 2030 (Shepherd and others 2013). Global financial and economic shocks have also negatively affected growth, inequality, and poverty in developing countries (World Bank 2010). These countries are affected by the economic woes in developed countries through trade and financial channels (UN 2011). In a world where both natural and economic shocks and crises are becoming more frequent, there is urgency for countries to build resilience and protect themselves from development reversals (Seth and Ragab 2012).

Undoubtedly, SIDS are increasingly being impacted by these extreme events and external shocks. The UN (2010)

reported an increase in the frequency and intensity of natural disasters, particularly storms and floods, in SIDS. The EMDAT Disaster Database also shows a clear increase in the number of natural disasters occurring in the SIDS between 1970 and 2010[83]. Over 110 and 187 disasters affected the Pacific and Caribbean regions, respectively, between 2000 and 2011 (UNISDR 2013). The World Risk Index presented in the 2012 World Risk Report (UNU 2012) identifies global disaster risk hotspots where high exposure to natural hazards and climate change coincides with very vulnerable societies. Among the 15 countries with the highest risk worldwide, eight are island states, with Vanuatu and Tonga in the top two positions. Moreover, the impacts of these events are intensified in many SIDS, due to negative synergies between population increase, environmental degradation, inappropriate environmental engineering and construction, and climate change and sea level rise (Thaman 2013).

The challenges related to extreme events are exacerbated by the lack of capacity and limited financing to effectively implement management strategies, and moreover, because available resources continue to flow primarily to post-disaster activities instead of disaster risk reduction and improvement of coping capacity (UN ECOSOC 2010). Of the SIDS that adopted the Hyogo Framework of Action for Disaster Risk Reduction aimed at substantially reducing disaster losses by 2015, only four had national platforms for disaster reduction as at 2010 (UN 2010).

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Importance and Relevance to SIDS' Sustainable Development

SIDS have a disproportionately high inherent and increasing vulnerability to global perturbations and crises in terms of their exports, tourism, transport, energy supplies, and food security. Statistics show that extreme events are hampering SIDS sustainable development. For example, the direct losses caused by Cyclone Ivan in 2004 to Grenada were estimated to be around USD900 million, more than twice the country's GDP. Cyclone Evan, which hit the South Pacific in 2012, resulted in total losses in Samoa equivalent to one third of the country's annual economic output (UNISDR and UN OHRLLS 2013). It is not surprising that Grenada and Samoa, along with Saint Lucia, Vanuatu, Tonga, and the Maldives, led the list of 180 countries with the highest economic losses on capital stock due to natural disasters between 1970 and 2006 (Baritto 2008). UN (2010) concluded that climate change induced disasters have undone the development achievement in SIDS.

Many SIDS economies are also highly exposed to external shocks resulting from their heavy dependence on a few markets and the erosion of trade preferences within these markets (UN 2010). SIDS are inherently economically vulnerable due to, among other factors, their remoteness and insularity, limited ability to diversify, strong dependence on a narrow range of exports, and high import content, particularly of strategic goods such as food and fuel, whose prices have exhibited high volatility. In addition, in recent years many SIDS have experienced a rapid rise in their debt burden which, coupled with rising logistics costs and decreasing workers' remittances, has exacerbated the negative impact of the global financial crisis on their economies (UN 2010). These challenges are typified by some of the major trade developments in Caribbean SIDS such as erosion of trade preferences and increase in the global market share of their trade competitors (World Bank/OAS 2009).

The combination of this growing exposure to environmental and economic pressures is an increasing potential threat to SIDS in terms of their capacity for trade, tourism, transport, energy supplies, and food security. Their small size and limited specialist technical capacities for disaster preparation and risk management inhibits their ability to avoid shocks and to confront extreme events and recover quickly from their impacts, in comparison with continental and more developed island states.

Moving Forward

A strategic approach to building resilience to external shocks and reducing risk from natural disasters at regional, national, and local levels is necessary. Strategies for building resilience include (a) building coping capacities to withstand and counteract shocks (including through basic education, infrastructural development, improved building and planning codes, and poverty reduction); (b) strengthening existing and developing new early warning systems to alert population and authorities to impending events and allow timely actions; (c) strengthening disaster risk reduction capacity in SIDS, for example, through ecosystem-based adaptation; and (d) eliminating the anthropogenic causes of the increased frequency of extreme events, including global warming and environmental degradation (Seth and Ragab 2012; UNEP 2012).

It is important, however, that strategies to build resilience include the balanced interest of all stakeholders. Such strategies should also enable and support national action, ownership, and inclusion; be underpinned by good governance; and must inform international efforts on disaster risk reduction and climate change. Pacific and

83 http://www.emdat.be/disaster-trends

Caribbean countries are making significant progress in the development of integrated strategies for the management of disasters and climate change at both regional and national levels[84].

The small size of SIDS provides many advantages that are well suited to building internal sustainability and resilience to external impacts. These include capacity for government and other 'governors', including civil society, to interact with more members of the entire population through various media; the prevalence of relatively small private sector entities that can be expected to be socially responsible; and the technical advantages and feasibility of land use and marine spatial planning at the national scale.

Building resilience to external economic shocks can be effectively approached at the regional level. For instance, the ongoing process of regional trade integration that is taking place through the Caribbean Single Market and Economy[85] offers opportunities to address some of the challenges faced by the region. Similarly, in the Pacific, steps have been taken towards establishing a regional free trade agreement through the Pacific Island Countries Trade Agreement.

Availability of improved disaster and shock-related insurance is also critical (Linnerooth-Bayer and others 2011). For example, micro-insurance can assist recovery from adverse events. Nevertheless, thus far insurance arrangements have not been successful in the Caribbean or the Pacific, despite the creation of the Caribbean Catastrophe Risk Insurance Project and the Pacific Disaster Risk Financing and Insurance Programme. The supported insurance schemes often do not cover all types of disasters or adequately cover them, while commercial schemes involve unaffordable premiums for most families. Research suggests that the expansion of the micro-insurance market can be facilitated by pairing large insurance providers with smaller micro-finance institutions (Khan and others 2013). Another option is a global insurance scheme supported by the international community to subsidize natural disasters insurance premiums and support vulnerable communities in building their resilience to hazardous events. In addition, social safety nets should be accompanied by robust efforts to strengthen existing livelihoods, diversify incomes, and incorporate differential vulnerability assessments (Khandker and others 2011). Most communities will experience both extreme events and slow onset processes. Therefore, it is important that strategies that respond to loss and damage in the short-term do not exacerbate efforts to address loss and damage in the long-term (Shamsuddoha and others 2013).

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84 http://sids-l.iisd.org/news/pacific-countries-to-develop-integrated-regional-disaster-risk-managementclimate-change-strategy-by-2015/

85 http://www.caricom.org/jsp/single_market/single_market_index.jsp?menu=csme

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Issue 020: Climate and Environmental Change Driving Population Displacements

Current Situation

Mass migrations of people have been a longstanding feature of humanity, arising from many causes including war, civil conflict, and the search for new economic opportunities. However, in recent times, another driver of this phenomenon has emerged—climate and environmental change. The IMO (2009) defined environmental migrants as 'persons or groups of persons who, for compelling reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.'

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A growing volume of studies suggests that environmental change will become an increasingly decisive factor in the displacement of people. The new and ongoing aspects of environmental change that will contribute to future migration are rapid-onset events related to climate change (such as more frequent or intense hurricanes and coastal flooding and associated natural disasters), and slow-onset processes (such as sea level rise, salinization of water supplies as well as more frequent droughts and land degradation/desertification). Droughts and desertification are currently the major drivers of slow-onset environmental crises, but floods and erosion associated with sea level rise are growing threats as global warming intensifies (IMO 2009; Gemenne and others 2012). Thus, human mobility is expected to continue and to increasingly become a consequence of and a response to climate change impacts on livelihoods (Gemenne and others 2012). Estimates of future environmental migrants range upwards from 200 million by 2050, according to various studies reviewed by the International Organization for Migration. The gravity of this issue is reflected in the call for an international convention for persons displaced by climate change, partly because of the inadequate assistance and provisions for their protection in international law (Burkett 2011; Hodgkinson and Young 2012).

Importance and Relevance to SIDS' Sustainable Development

The push of limited opportunities on islands combined with the pull of better horizons in foreign lands has long fuelled emigration from islands. The Caribbean SIDS, for instance, have always had a very itinerant population and a history of emigration. This trend is increasing among the skilled and educated people. Other push factors are now coming into play in the form of continuing environmental degradation as well as climate change and sea level rise that present an immediate crisis to low-lying islands. As a consequence, the prospect of entire islands becoming uninhabitable, fuelling an even greater emigration rate is increasingly likely. Studies have shown the possibility of atoll islands becoming uninhabitable due to salinization of groundwater, resulting in forced migration of people as environmental refugees (Chui and Terry 2012; Terry and Chui 2012; Terry and Falkland 2010). IMO (2009) states that "hotspot" countries including Tuvalu and Maldives are already facing environmental-related migration pressures, which is expected to worsen in coming years. Environmental degradation and climate change are also fuelling internal migration and are leading to further degradation within the SIDS (Alscher 2010).

This issue is of particular importance in the Pacific SIDS, where many islands are low-lying and therefore are more threatened by sea level rise and its associated impacts. The world's first climate change refugees were most likely the 2,600 persons relocated from the low-lying Carteret Island in Papua New Guinea because of sea level rise (Burkett 2011). Other countries, such as the Maldives, are faced with the potential loss of their entire territories. Recognizing this, the President of the Maldives has publicly expressed the desire to acquire land outside of the territory to relocate the entire population to safer grounds. Environmental degradation has made Haiti, which is among the poorest countries in the western hemisphere, one of the world's most natural disaster-prone countries (Williams 2011). At least 90 per cent of Haiti's soils have been severely degraded by deforestation and inappropriate cultivation practices. Severe environmental degradation and chronic poverty in this country are strong drivers for emigration to the adjacent Dominican Republic and other countries. Large scale short- and long-term migration from Haiti to the Dominican Republic occurs all along the border between the two countries (UNEP 2013).

Forced population displacements present a number of challenges, both for the islands themselves and the host countries. For example, island countries have to ensure a

demographic equilibrium across age groups, cope with the 'brain drain' that limits local human capacity, and maintain island heritage and cultural unity across the diaspora. The receiving country, on the other hand, must deal with the assimilation of immigrants while supporting the persistence of island social structures and culture.

Moving Forward

UNEP (2012) suggested some options for responding to the challenges of environmental-induced migration. These include (1) addressing the root causes of migration by reducing environmental degradation, improving coastal protection, drought planning, and land restoration; (2) incorporating environmental migration challenges as part of National Adaptation Programmes of Action being developed under the UN Framework Convention for Climate Change; and (3) possible broadening of immigration policies across countries to include environmental migrants.

Addressing the issue of loss of island territories and forced migration arising from climate change needs to be underpinned by an appropriate international and regional legal regime and early efforts in planning and coordination (Burkett 2011). Biermann and Boas (2010) have argued that environmental migrants should be protected under specific international legal agreements, for example, a protocol under the UN Climate Chaneg Convention.

Awareness should be raised at all levels, including schools and the grass-root level, about the potential impact of climate change, so that the population can be better prepared. It must also be recognized that despite its negative impacts, migration also has benefits such as improved access to financial and social capital, reduced pressure on natural resources, and reduced vulnerability of island communities to extreme weather events and other hazards. Hence, migration has been viewed as a form of climate change adaptation for atoll islands (Birk and Rasmussen 2014).

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Part II

UN DESA
Socio-Economic Issues

Table 2: The 15 SIDS' Socio-Economic Issues

Issue ID	Issue Title
001	Need to diversify SIDS economies
002	Innovative approaches to debt relief
003	Shoring up traditional local and indigenous knowledge
004	Reinforcing social cohesion
005	Rediscovering opportunities for youth
006	New challenges in gender
007	Health challenges in SIDS
008	Preserving an authentic cultural heritage and identity
009	Making tourism sustainable
010	Climate and Economic Drivers of Migration
011	The future of food security in SIDS
012	Freshwater management for the 21st century
013	Need for enhanced disaster preparedness
014	Economic and social impact of climate change
015	Diminishing Resources for Development Financing

Issue 001 Need to Diversify SIDS Economies

In many cases, SIDS economies have developed by relying on a relatively narrow base of commodity exports as well as a small range of service sectors, notably tourism, real estate and construction. SIDS vulnerability to economic shocks has been recognized for decades, but the global financial and economic crisis highlighted this with new intensity as export earnings, foreign investment, and tourism revenue all fell simultaneously. In this context, SIDS are seeking to diversify more extensively into services and cultural industries, especially given their limited ability to capitalize on the economies of scale in the production of goods. Some SIDS have also invested in offshore financial services but this sector faces an uncertain future in light of heightened international concerns about the potential for these jurisdictions to act as tax havens.

Policy Implications

To achieve diversified, sustainable growth, decision makers will need to pursue long term integrated policy planning, with transparent and inclusive governance as the starting point. Regional cooperation and sharing of best practices can lead to progress, especially as some SIDS create enabling environments for new investments and industries, including technology-based and service industries as well as renewable energy. Renewable energies are an area of great potential, especially given the high cost of fossil fuel exports; and ocean thermal, wind, solar, and others are being explored in SIDS. SIDS are also capitalizing on other areas of strength, including cultural industries such as performing arts, visual and media arts training, galleries, museums, festivals, music, and literary and film industries. These industries—as well as sports—are potentially powerful employment and economic engines, and decision makers are recognizing this potential. These and other approaches to economic diversification will be successful only with adequate investment in education, technology development, and research, with due regard for the environment.

Issue 002 Innovative Approaches to Debt Relief

In the aftermath of the global financial and economic crisis, many SIDS were saddled with high and unsustainable levels of debt. As in many parts of the world, the overall fiscal response, to cut spending and institute austerity, has inflicted damage on some SIDS societies and on their opportunities for economic recovery. In the case of the Caribbean, the designation as "middle income" countries disqualifies them for concessionary financing and further hobbles recovery and growth.

Policy Implications

Some SIDS are exploring alternative responses to debt, including innovative debt swaps, in which the SIDS government agrees to institute an environmentally sound policy or initiative in exchange for a renegotiation of the debt. Environmental benefits can include preserving biodiversity; maintaining ecosystems; promoting responsible use of land, water, coastal and other natural resources; and other conservation advances.

Issue 003 Shoring Up Traditional Local and Indigenous Knowledge

As SIDS face the increasingly complex problems of the globalized modern world, they are finding that traditional and indigenous knowledge systems have a great deal to offer to the implementation of sustainable development. Through the process of globalization, much traditional and indigenous knowledge has been lost. But the keepers of local and indigenous knowledge are cognizant of its value and are working to preserve it in areas as diverse as disaster preparedness, health and wellness, construction practices, and conservation. Communities in all SIDS are recognizing the irreplaceable value of traditional knowledge and are promoting a "third way," combining traditional knowledge with modern science to address the challenges of the 21st century.

Policy Implications

Mapping local and indigenous knowledge, whether in a written format or through documentary film or other media, is a vital first step to preserving these systems of knowledge and learning. Regional and SIDS-SIDS cooperation can be valuable in this context. Resilience-building that is primarily science and technology-based should take into account local culture, tradition and know-how, and unique traditional agricultural systems can also provide models for more sustainable food production in the future. Creating seed banks can protect biodiversity of native plants, and consideration should also be given to protecting the rights of indigenous communities to the genetic resources of their traditional plants. Developing software and applications to attract the younger generations to indigenous knowledge could also help to ensure that the knowledge is not lost.

Issue 004 Reinforcing Social Cohesion

While the weakening of societal and family structures is not in itself a new issue for SIDS, its impact is being felt more than ever before in a range of realms, from gender relations to crime and violence to reduced opportunities for youth to migration. The breakdown of social cohesion is defined by the loss of traditional societal (e.g. family, gender, class, culture, and generational) structures and values, and the process is often influenced, reinforced, and hastened by external shocks and globalization. For example, the global financial and economic crisis is increasing economic inequality, widening the gulf between rich and poor within a country. And as the crisis and high debt levels lead to government budget cuts, the social protection mechanisms provided by the state are withering. In some cases, alternative and informal support systems, including gangs and other anti-social structures, can rise to fill the void. Or, the breakdown can spur emigration, which can tear the bonds between generations or neighbors and remove community safety nets, which can, in turn, drive individuals to low self esteem or domestic violence and other crime.

Policy Implications

This is a deeply complex and multi-faceted challenge, complicated by the fact that loss of social cohesion is both a cause and an effect of a host of other social problems. Ideally, the old structures could be bolstered by improved, inclusive, and culturally-rooted social models, but little progress can be made without enlisting a wide variety of stakeholders. Enhancing the role of civil society and religious groups, fostering positive role models in the worlds of arts and sports: these are concrete steps that may help to address the reality of a breakdown in social cohesion. In many cases, governments may also choose to devote new and additional resources to social services.

Issue 005 Rediscovering Opportunities for Youth

Declining levels of youth employment and opportunities can accentuate the breakdown in social cohesion described above. The lack of opportunity for youth is a dire crisis for SIDS because when educated youths fail to find employment, and are unable to envision a future at home, they will leave their home island, leading to "brain drain," sapping the island's future. In some SIDS, young men, including educated men, are entering prison at alarming rates. Youth are also suffering from diminished opportunities for informal and traditional education within communities.

Social media and information technology can take on a particularly important role in the youth of SIDS, given their remoteness and small population pool, and in this context it is important to note both the threats and the opportunities presented by technology.

Policy Implications

Beyond addressing the economic realities that limit the employment opportunities, SIDS could invest in civil society support, leadership training, and formal and informal education for youth. Educational systems should include knowledge and skills relevant to island living and empower young people to become change agents for sustainability within their own communities.

Issue 006 New Challenges in Gender

Emerging issues in gender vary from SIDS region to SIDS region, and the goal will be to address the problems without losing sight of the progress and positive developments. Traditional gender roles are changing in all SIDS regions, often to the benefit of women. Women are becoming educated, owning land, and entering the workforce in higher numbers than ever before, and, in some cases, in higher numbers than their male counterparts. At the same time, economic opportunity in general is shrinking, especially during and in the aftermath of the global economic and financial crisis.

While data shows that in fact women are still more likely to be unemployed than men, and are lower paid, many men are not able to find work. This lack of economic opportunity can exacerbate a "crisis of masculinity" arising from a weakened breadwinner role, and this can give rise to hopelessness, crime, and violence—including domestic violence, which undermines women's empowerment in other spheres.

Policy Implications

It is important for decision makers to recognize both sides of the gender equation: the changes that benefit women and men and those that may destabilize them. SIDS have indicated a desire to continue the collection and analysis of gender disaggregated data, the implementation of the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), and an increase in the prominence of women in all levels of government.

Issue 007 Health Challenges in SIDS

As SIDS are increasingly integrated into the global economy and culture, SIDS populations are threatened by many of the same health concerns facing the rest of the world. Non-communicable diseases including diabetes, obesity, and heart disease are afflicting SIDS as they adopt the poor dietary habits and nutrition choices of the developed world. Trauma, too, is an in increasingly significant problem, with traffic accidents, violence and natural disasters all on the rise. And environmental pollution exposes populations to respiratory disease and other health hazards. In many cases, the health care infrastructure is not equipped to deal with these new stresses, and so people do not always get the care they need. Preventive health care is particularly lacking.

Policy Implications

SIDS can explore regional cooperation, sharing of expertise and best practices, to address these new health care challenges. In addition, traditional and indigenous knowledge should be integrated into the responses.

Issue 008 Preserving an Authentic Cultural Heritage and Identity

SIDS have developed distinct cultural heritage, from music and dance to the traditional knowledge and practices mentioned above. This culture is central to SIDS identity in many cases, and it feeds the world's perceptions and projections of island society. As mentioned above, cultural industries can be sources of employment and powerful drivers of economic development. However, while SIDS may capitalize on these "national brands" to advance tourism, SIDS people are increasingly conscious of the potentially deleterious impact they may have on SIDS sustainable development and authentic cultural identity.

Policy Implications

By promoting island culture, SIDS governments are celebrating and maximizing aspects of what makes SIDS unique. Decisions will be made to emphasize the authentic value of SIDS culture while guarding against over-simplification and stereotyping that can dilute and blur SIDS identity.

Issue 009 Making Tourism Sustainable

While tourism forms the backbone of many SIDS economies, it can also be potentially damaging to SIDS natural resources and cultural identity. Certain kinds of tourism can be especially resource intensive with little economic upside, including all-inclusive cruise and tour companies that bring visitors who spend little money in the islands themselves and also bring the invasive species that are wreaking havoc on native flora and fauna.

Policy Implications

Though tourism does present the challenges outlined above, if designed properly, the industry can contribute to the labor market in a way that promotes sustainable development and alleviates many of the critical social problems detailed in the current report. SIDS can determine the tourist carrying capacity of their island and can impose caps on numbers that exceed that level. Impact fees, charged to tourists to offset the damage they may inflict on the islands they visit, are another way to mitigate the damage. Decision makers could continue encouraging tourism that respects and celebrates the unique culture of SIDS, including by promoting the UNESCO World Heritage Sites in SIDS, and by advocating to move those sites on the "Tentative List" into full UNESCO recognition status. Expanding specialized tourism sectors, such as medical-, spa-, and eco-tourism, can also bring new opportunities for skilled employment and encourage sustainable development-friendly growth.

Issue 010 Climate and Economic Drivers of Migration

Peoples have always moved in and out of small island developing states, but a number of 21st-century realities are contributing to new levels and patterns of migration. Climate change and extreme weather are driving migration, as storms destroy homes and infrastructure, and as prospects for the future dissolve in rising sea levels. In addition, the economic realities of many SIDS are compelling people to leave, giving rise to "brain drain," and, for those who stay behind, "brain stretch." The selective immigration policies of developed countries reinforce this tendency, as only the most highly educated individuals are welcomed as immigrants.

Those who leave the SIDS—the diaspora—may face challenges integrating into their new communities in some countries. In addition, when SIDS are the *recipients* of

migrants, whether from SIDS or other states, they may face competition between immigrants and native populations, a strain on infrastructure, and resulting social and cultural tensions.

Policy Implications

Policies encouraging "brain circulation"—so that those who emigrate can return, or at least share their skills and expertise with their home countries—could help address the harmful effects that migration can have on SIDS. The goal is not to prevent people from leaving but rather to continue integrating the diaspora into the society and economy of their home countries, not only through remittances but also through "diaspora bonds" and other innovative mechanisms. Migration can potentially create fertile ground for SIDS-SIDS cooperation, and the sharing of best practices, technology and training. The historical and strategic position of SIDS in trade and travel routes can be capitalized upon by fostering a dynamic and mobile society in which individuals may leave but continue to support and invest in their home country.

Issue 011 The Future of Food Security in SIDS

The concurrent financial and food crises that started in 2008 highlighted the vulnerability created by the dependence of SIDS on food imports. For years, many SIDS had moved resources away from local and traditional food production—agriculture and fisheries—toward investments in tourism and in some cases industrial and urban development. This left SIDS vulnerable to spikes in food prices, and, in the aftermath of the crises, has led decision makers to contemplate the future: whether to continue down the current path or to consider a return to more local food production. These decisions will also have significant impacts on biodiversity and traditional knowledge.

Policy Implications

Land use policies will be central to ensuring the food security of SIDS populations, all the more so because of the limited land resources of SIDS. Land, especially coastland, is in high demand by the tourism industry, foreign investors, and others, and SIDS will be making important decisions on land use in the coming years. An ecosystem based management approach to food security will address not only adequate food supply but high quality, safe, nutritious food, including that produced by organic methods and with the participation of local communities. SIDS could become leaders in new more intensive forms of agriculture (hydroponics, permaculture) that use less land. On the global level, developed world policies including deregulation and agricultural subsidies have a significant impact SIDS food security and should be reexamined.

Issue 012 Freshwater Management for the 21st Century

With sea level rise, salt water intrusion, and extreme weather events including flooding and drought, the supply of adequate and quality drinking water will be an increasingly difficult issue in the coming years. The concept of "peak water" shows that the globe may have already passed the level of greatest possible rate of consumption. SIDS are on the front lines of water scarcity, and SIDS water management policies and practice must reflect this reality.

Policy Implications

Integrated water management, including innovative approaches to water recycling will be key. In particular, some SIDS can share best practices in recycling gray water as well as in advocacy and education campaigns that support water conservation. Policy makers will likely seek to balance the need for innovative management approaches with the risks posed by the privatization or commoditization of water. Research should focus on, among other areas, using renewable energy in water desalination.

Issue 013 Need for Enhanced Disaster Preparedness

SIDS have always suffered from extreme vulnerability to natural disasters. Beyond the environmental damage sustained, the small size of SIDS economies mean that a single storm can devastate a SIDS national economy.[86]

With the expansion of coastland development, for the tourism industry and other sectors, the economic impact of storms and sea level rise increases every year. This new development usually follows the high-impact approach of modern construction practices and not the traditional, low-impact approaches that have historically served SIDS communities well. As climate change makes storms more intense and more frequent, the economic impact can be catastrophic.

86 When Hurricane Ivan struck Grenada in 2004, for instance, the island sustained US$800 million in damage, which was twice Grenada's GDP. Nearly 85 percent of the nutmeg crop suffered some damage, and 60 percent was destroyed, and 89 percent of the country's housing was damaged (World Bank, 2005)

As mentioned above, much of the traditional and indigenous knowledge around disaster preparedness and risk reduction has been lost. Whether reading the cues of animals to help predict storms, or using storm-resistant construction practices, communities have relied on knowledge passed down from generation to generation to protect their homes and families and build resilience. As this knowledge fades, vulnerability increases. Disaster resilience thus represents a nexus of cultural, social, economic and environmental challenges, and addressing all the issues in a holistic manner is an emerging imperative for SIDS.

Policy Implications

In all areas of disaster preparedness, from early warning systems to improved planning and management approaches, SIDS governments are sharing best practices and cooperating within and between regions.[87] In the political realm, SIDS will need to continue addressing issues of governance and policy planning to minimize the vulnerability of SIDS communities and businesses to disasters. Industry leaders in tourism and other sectors will likewise need to make informed decisions on coastal construction and land use. And as the costs of rebuilding after natural disasters continues to increase, SIDS will need to include this in their economic planning and budgets. This issue links to the broader question of responsibility for climate change adaptation costs, discussed below.

87 The Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions of the Intergovernmental Oceanographic Commission is one such mechanism encouraging regional cooperation.

Issue 014 Economic and Social Impact of Climate Change

Climate change is certainly not an emerging issue, especially for the SIDS who are in so many ways on the front lines of its devastating effects. Also very familiar are the ways that economic activity—industry, food production, transport—and social developments—population growth, increased urbanization and rising standards of living—contribute to climate change. However, a deepening understanding is emerging of the ways that climate change itself is, in turn, damaging SIDS social, cultural and economic structures, and the increasingly dire forms this damage will take in the future.

Agricultural production, fisheries, and related sectors will change and decline as the climate changes, threatening livelihoods and economic growth. The economic implications of sea level rise, destruction of the coral reefs, and loss of biodiversity are massive and potentially devastating. In addition, extreme weather spawned by climate change is destroying SIDS land, real estate and infrastructure, with economically catastrophic effects. In the most dire cases, SIDS governments are contemplating purchasing land in the other countries to prepare for the eventuality of territory loss. But even in SIDS not taking these drastic steps, decision makers are faced with an increasingly urgent need to enact policies addressing climate change.

As illustrated in the statements above, many of the emerging issues in SIDS are rooted at least in part in the impacts of climate change. An elaboration of a few sample issues follows.

- **Traditional sources of food security:** Climate change undermines SIDS fisheries and agricultural production.[88] As the ocean temperatures rise, fish stocks move or die, and subsistence SIDS fisher folk struggle to adapt to the new reality. In some cases they may be able to follow the fish, but more often they lack the tools or technology to make those changes, and their livelihood and food supply are decimated. Similarly, for agricultural communities, the changing weather and climate may render their traditional crops and farming techniques obsolete. As the sea level rises, SIDS lose land and ground water aquifers, which further threatens food production. Draught and flooding, collateral effects of climate change, also reduce agricultural productivity and threaten food security. And communities based around the rhythms of artisanal fishing or farming are losing the cohesion that was rooted in their common experiences, leading to the multitude of social challenges discussed in statements 4, 5, and 6, above.
- **Migration:** As mentioned above, climate change is creating situations of forced migration. Already, people are leaving SIDS as the islands lose territory to the rising sea levels. This will only increase in the coming years, as young people leave their home islands, unable to see a viable future. As they migrate from their home communities, they may lose the local and indigenous knowledge passed inter-generationally. Ironically, that local and indigenous knowledge has traditionally included approaches to disaster preparedness, construction, and land use that would be all the more vital now that climate change is intensifying SIDS vulnerability.
- **Tourism:** Tourism forms the foundation of many SIDS economies, and the impact that climate change is having and will have on the tourism industry is undeniable. Coral bleaching, mangrove forest inundation, and immersion of turtle nests and sea bird habitats all threaten major assets drawing visitors to SIDS. Tourists are also discouraged from travelling to SIDS for fear of yet another violent and life-threatening storm. And as valuable coastland is lost to sea level rise, the resorts

88 Even though, as discussed in statement 11, these traditional sources of food may not provide the bulk of food in all SIDS, they are nonetheless critical to SIDS society and culture.

and hotels that often occupy that prime real estate will be all the more vulnerable to storm surges and other extreme weather events. If the tourism industry contracts, SIDS economies will suffer devastating losses.

Policy Implications

The environmental facts of climate change—loss of biodiversity, degradation of coastal resources and ocean health, destruction of natural habitats—are tragedies in and of themselves, but it may be the accompanying social and economic upheavals that drive SIDS policy makers to act, (and to exert the moral pressure on the non-SIDS governments more responsible for the emissions that create the problems). SIDS actions toward mitigation can serve as examples or pilot cases for the rest of the world, but since SIDS together create less than one percent of global emissions, even the most aggressive mitigation efforts will have almost no impact on the planet's climate.

SIDS leaders will therefore act rather to adapt to climate change and its social and economic costs. The question then becomes who will pay for adaptation, and not only the immediately apparent measures like building sea walls or moving communities to higher ground, but also those myriad social and economic effects that appear two or three links down the causal chains. Consideration must be given to the question of who bears the financial responsibility for climate change, ultimately with financial mechanisms put in place that reflect this responsibility.

Issue 015 Diminishing Resources for Development Financing

Underpinning all of the challenges outlined above is the fact that SIDS are finding it increasingly difficult to access financing for development. During and after the global economic and financial crisis, economic activity in many SIDS has been shrinking and debt levels rising. Investment flows and donor resources from abroad have likewise been contracting. SIDS governments have been forced to make difficult budgeting decisions and to undertake monetary and fiscal tightening. As discussed above, social services and other building blocks for sustainable development have suffered.

Policy Implications

Financing for development is a multifaceted issue that must be approached holistically in order to yield effective progress. Domestically, SIDS governments may look to create enabling environments for small and medium-sized enterprises, emphasizing inclusive growth through access to financing but also to savings, insurance and other services. Strengthening governance and addressing corruption issues will further bolster inclusive growth. The international community must likewise foster inclusive growth in SIDS, by increasing consistency and effectiveness of the international monetary, financial and trading systems as well as the international financial architecture. This will include a hard look at agricultural subsidies and other protectionist measures, which increased in the aftermath of the economic crisis. Globally, official development assistance (ODA), still stands far below the 0.7 percent of GDP goal set in Monterrey in 2002. Increasing ODA, especially if done hand-in-hand with expanded technical cooperation and other partnerships, will improve the landscape for ongoing sustainable development in SIDS.

United Nations Environment Programme
P.O. Box 30552 - 00100 Nairobi, Kenya
Tel.: +254 20 762 1234
Fax: +254 20 762 3927
e-mail: uneppub@unep.org
www.unep.org

UNEP

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