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INTEGRATION OF CLIMATE CHANGE IMPACTS AND RESPONSE ACTIVITIES WITHIN THE PROGRAMME OF WORK ON ISLAND BIODIVERSITY

Note by the Executive Secretary

I. INTRODUCTION

1. Decision IX/16 of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD), on biodiversity and climate change, requests the Executive Secretary, when conducting the in-depth review of the programmes of work, to integrate climate change considerations where relevant and appropriate considering the following:

(a) The assessment of potential impacts of climate change[1] and both the positive and negative impacts of climate change mitigation and adaptation activities on relevant ecosystems;

(b) The most vulnerable components of biodiversity;

(c) The risks and consequences for ecosystem services and human well-being;

(d) The threats and likely impacts of climate change[1] and both the positive and negative impacts of climate change mitigation and adaptation activities on biodiversity and the opportunities they provide for the conservation and sustainable use of biodiversity;

(e) Monitoring of the threats and likely impacts of climate change,[1] and both the positive and negative impacts of climate change mitigation and adaptation activities on biodiversity;

(f) Appropriate monitoring and evaluation techniques, related technology transfer and capacity-building support within the programmes of work;

(g) Critical knowledge needed to support implementation, including *inter alia*, scientific research, availability of data, appropriate measurement and monitoring techniques technology and traditional knowledge;

(h) The ecosystem-approach principles and guidance and the precautionary approach;

* UNEP/CBD/SBSTTA/16/1.

1 Including increasing climate variability and increasing frequency and intensity of extreme weather events.

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(i) The contribution of biodiversity to climate-change adaptation, and measures that enhance the adaptive potential of components of biodiversity.

2. The same decision also requested that, when preparing for the in-depth review of the programmes of work of the Convention, to take into account an analysis to identify the elements of the guidance (paragraph 1 above) already included in the existing programmes of work and an assessment of the state of implementation, as well as the identification of gaps in implementation including a review of barriers and suggestions to overcome them.

3. Accordingly, the present note provides information on the integration of climate change impacts and response activities within the programme of work on island biodiversity taking into account the above listed guidance.

II. CLIMATE CHANGE IMPACTS AND RESPONSE ACTIVITIES IN THE PROGRAMME OF WORK ON ISLAND BIODIVERSITY

4. The programme of work on island biodiversity is set out in the annex to decision VIII/1. The programme of work recognizes the particular vulnerability of islands to climate change and the need for collaboration with organizations such as the United Nations Framework Convention on Climate Change.

5. Goal 7 of the programme of work is to address challenges to island biodiversity from climate change and pollution, through the maintenance and enhancement of the resilience of the components of biodiversity to adapt to climate change in islands. To achieve this goal, Parties are called on to:

(a) Research and implement adaptation and mitigation measures in land-use and coastal zone planning and strategies to strengthen local-level biodiversity resilience to climate change; and

(b) Create where feasible viable national systems of protected areas that are resilient to climate change.

6. Decision VIII/1 also identifies a number of suggested supporting actions that relate to climate change which Parties may consider when implementing the island biodiversity programme of work, such as the following:

(a) Integrate climate change adaptation measures when establishing networks of island protected areas;

(b) Develop monitoring techniques to identify and monitor the impacts of climate change on key species;

(c) Develop models to understand the vulnerability of island biodiversity to climate change, including:

- Understand how sea level rise and other aspects of climate change threaten island biodiversity;
- Develop general circulation models and other scientific tools to help understand and adapt to the impacts of climate change on island biodiversity.

(d) Monitor and exchange information on the impacts of global climate change on island biodiversity;

(e) Strengthen national capacity to address climate change issues for island biodiversity;

(f) Identify species (e.g., corals) that are resilient to climate change in order to use those species for restoration;

(g) Reduce chemical and physical degradation of coral reefs to facilitate recovery from climate-induced bleaching;

(h) Identify and protect sites whose environmental conditions favour the maintenance and recovery of species and ecosystems under changed climate and sea level;

(i) Identify and implement effective early-warning systems (forecasting) and strategies that address natural hazards and their impacts on island biodiversity and its recovery capacity, such as tsunamis, hurricanes, storm surges, floods, and tropical storms and longer-term trends such as climate change, sea level rise, El Niño and La Niña phenomena.

A. Assessment of implementation

7. The extent to which Parties have implemented the climate change elements of the island biodiversity programme of work has been assessed based on an analysis of fourth national reports to the Convention on Biological Diversity. The second, third and fourth national communications to the UNFCCC, as well as available National Adaptation Programmes of Actions (NAPAs), were also analysed to identify biodiversity-related adaptation and/or mitigation activities.

8. The analysis of fourth national reports under the Convention on Biological Diversity from island Parties and selected Parties with islands (46 submissions[2]), indicates almost universal identification of climate change as one of the threats to biodiversity. Most Parties discussed climate change vulnerability and projected or observed impacts on biodiversity, such as coral bleaching, sea level rise (and associated impacts such as salt-water intrusion and increased erosion), increased risk from extreme events (e.g. floods, droughts, storms) and habitat shifts and/or loss.

9. 27 Parties[3] reported on climate change adaptation activities, many of them noting the role of biodiversity in ecosystem-based adaptation. Only eight Parties[4] reported on activities linking climate change mitigation to biodiversity, although two additional Parties[5] did recognize the need to enhance this link.

10. Examples of activities reported by Parties (see the annex below for additional details) include:

(a) Sustainable land use practices for soil and water resources;

(b) Mangrove conservation (for flood control and coastal defence, as well as carbon sequestration);

(c) Coastal zone management;

(d) Payments for mangrove ecosystem services, including adaptation services;

(e) Coastal reforestation for climate change mitigation and adaptation purposes;

(f) Wetland restoration for adaptation;

[2] The 33 island States (including Japan and Australia) and a selection of 13 Parties with islands who had submitted their fourth national report to the Secretariat by 1 July 2011 (Argentina, Brazil, Chile, Denmark, Ecuador, France, Mexico, Netherlands, Peru, Portugal, Spain the United Kingdom and Venezuela).

[3] Antigua and Barbuda, Australia, Bahamas, Cape Verde, Cook Islands ,Cuba, Cyprus, Fiji, Grenada, Madagascar, Maldives, Malta, Mauritius, Micronesia (Federated States of), Niue, Papua New Guinea, Philippines, Saint Lucia, Samoa, Sao Tome and Principe, Singapore, Solomon Islands, Sri Lanka, St. Vincent and the Grenadines, Tonga, Trinidad and Tobago, and Tuvalu.

[4] Antigua and Barbuda, Dominican Republic, Malta, Papua New Guinea, Solomon Islands, Sri Lanka, Trinidad and Tobago and UK (Overseas Territories).

[5] Micronesia (Federated States of) and Samoa.

(g) Early warning systems (e.g., for agricultural, forest, wetland and mountain ecosystems).

11. In addition, three island Parties[6] reported on activities related to biodiversity and climate change in their national communications to the UNFCCC.[7] These activities include ecosystem-based approaches to adaptation, the establishment and expansion of protected areas, and coral reef and mangrove restoration.

12. The analysis of the NAPAs[8] indicates that all 11 island Parties reviewed had included biodiversity-related adaptation options in their NAPA, either through their priority adaptation needs, strategies or priority projects. Such ecosystem-based adaptation options include:

(a) Integrated water resources management;

(b) Restoration of degraded soils;

(c) Coral reef protection, restoration, and monitoring;

(d) Reforestation and sustainable forest management;

(e) Establishment of community-based conservation programs in vulnerable marine and terrestrial areas; and

(f) Establishment of coastal buffer zones and rehabilitation of mangroves.

13. Additional information on implementation of the island biodiversity programme of work is available in the in-depth review of the programme of work on island biodiversity (UNEP/CBD/SBSTTA/16/4) and the compilation of information from fourth national reports and voluntary reports/contributions submitted by Parties, other Government and organizations for the in-depth review (UNEP/CBD/SBSTTA/16/INF/3). Section III of the latter provides a synthesis of reports and submissions containing mentions of climate change adaptation and/or mitigation activities.

B. Gaps in the integration of climate change impact and response activities in the programme of work on island biodiversity

14. In reporting on activities, Parties also identified a number of barriers or needs for the further implementation of the climate change elements within the programme of work on island biodiversity. These include:

(a) Limited information on the vulnerability of biodiversity to climate change (Trinidad and Tobago);

(b) Limited financial resources (St Vincent and the Grenadines);

(c) Climate change mitigation potential limited due to small size of island State (Antigua and Barbuda);

(d) Need to integrate biodiversity and climate change in National Biodiversity Strategy and Action Plan (NBSAP) (Bahamas, Cook Islands);

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[6] Dominican Republic, Malta and Samoa.

[7] Based on an analysis of second, third and fourth national communications to the UNFCCC received by 1 January 2012.

[8] From the NAPAs received by January 2012, the NAPAs for the following island Parties were reviewed: Cape Verde, Comoros, Haiti, Kiribati, Madagascar, Maldives, Samoa, Sao Tome and Principe, Solomon Islands, Tuvalu, and Vanuatu.

(e) Need to integrate biodiversity monitoring into climate change policies (Federated States of Micronesia);

(f) Need for downscaled models and quantitative monitoring of local climate data to evaluate the impacts on biodiversity (Malta).

15. In addition to the above, general barriers to the enhanced integration of climate change within the Convention on Biological Diversity are also relevant for islands. These barriers are described in the in-depth review of the cross-cutting issue on biodiversity and climate change (UNEP/CBD/SBSTTA/14/6).

III. THE IMPACTS OF CLIMATE CHANGE AND RESPONSE ACTIVITIES ON ISLAND BIODIVERSITY

A. Assessment of potential impacts of climate change on island biodiversity

16. The special characteristics of islands (e.g., small land masses surrounded by oceans, geographically located in regions prone to natural disasters and extreme weather events, biodiversity-based livelihoods, socio-economic conditions) make them vulnerable to a large range of potential impacts from climate change and climate variability.

17. Island biodiversity is particularly vulnerable to climate change impacts due to typically high levels of endemic species with regionally restricted distribution caused by ecological isolation. According to the IPCC fourth assessment report, warming has already led to the replacement of some local species on a number of islands, especially those at higher latitudes. In addition, the capacity of species and ecosystems, such as mangroves, to shift their ranges and locations in response to climate change, may be hindered by land-use practices that fragment existing habitats.[9]

18. Islands are often characterised by high levels of biodiversity which provides essential goods and services for local communities. In particular, climate change is likely to heavily impact coral reefs, fisheries and other marine-based resources important for island peoples and economies.

19. Projected sea level rise poses a high risk for low-lying islands and their coastal resources (e.g., corals, mangroves, and reef fish). Related impacts include increased flooding, coastal erosion, and salt water intrusion. For example, predicted sea level rise in American Samoa (0.88 m to 2100) could lead to a 50% loss of mangrove area.[10] Another study reveals that, on average, up to 38% of the total current beach in Bonaire could be lost with a 0.5 m rise in sea level, with lower narrower beaches being the most vulnerable, reducing turtle nesting habitat by one-third.[11]

20. According to the IPCC,[12] owing to factors of limited size, availability, geology and topography, water resources in small islands are extremely vulnerable to changes and variations in climate, especially in rainfall. Increases in the frequency of hurricanes/typhoons can also negatively impact some habitats. In addition, rapid climate change could lead to greater numbers of introductions and enhanced colonisation by invasive alien species.

21. Islands, being surrounded by oceans and many of them being reliant on ocean-based livelihoods, are particularly vulnerable to climate change impacts on oceans and marine ecosystems. Observed and projected changes in oceans include:

9 IPCC (2002)
10 Gilman et al. (2006)
11 Fish et al. (2005)
12 IPCC (2007)

- *Increases in ocean temperature*. From 1961 – 2003, global ocean temperature rose by 0.10°C from the surface to a depth of 700 meters.[13] Global average land and ocean surface temperatures increased at a rate of about 0.2°C/decade over the last few decades.[14] More than 80% of the heat added to the climate system has been absorbed by the ocean.

- *Salinity*. Higher precipitation rates are observed at mid to high latitude and lower rates in the tropics and subtropics. Corresponding changes have been measured in surface water salinities, which involve freshening in subpolar latitudes and salinification of shallower parts of the tropical and subtropical oceans.[15]

- *Acidity*. Over half of anthropogenic carbon dioxide emissions to the atmosphere are absorbed by the ocean and land biospheres and the excess carbon absorbed by the ocean results in increased ocean acidity. The rate of ocean carbon uptake is controlled by ocean circulation and the vertical mixing of water masses. Most of the excess carbon is found in the upper few hundred meters of the ocean and in high-latitude regions, where cold dense waters sink into the deep ocean. Surface water pH values have already dropped by about 0.1 pH units from preindustrial levels and are expected to drop by an additional 0.14-0.35 units by the end of the 21st century.[16]

- *Sea level*. Global mean sea level has been rising. From 1961 to 2003, the average rate of sea level rise was 1.8 mm per year. For the 20th century, the average rate was 1.7 ± 0.5 mm per year.[17] The IPCC fourth assessment report includes predictions for sea level rise based on different modeling scenarios that range from 18 – 59 cm.

- *Sea ice*. The IPCC fourth assessment report stated that satellite data, since 1978, shows annual average arctic sea ice extent shrinking by 2.7% per decade, with larger decreases in summer of 7.4% per decade.[18] September Arctic ice-cover from 2002-2006 was 18% lower than pre-1980 ice cover,[19] and some models predict near ice-free conditions by 2040. Recent studies of the Greenland ice sheet highlight an alarming increase in surface melting over the summer, and percolation of that melt water to the base of the ice sheet where the melt-water could lubricate ice flow and potentially greatly accelerate ice loss and sea level rise. These new findings have not been fully incorporated into projected sea level rise estimates, which thus may be underestimated.[20]

B. The most vulnerable components of island biodiversity

22. According to the Second Ad Hoc Technical Expert Group (AHTEG) on biodiversity and climate change,[21] species with limited climatic ranges and/or restricted habitat requirements are typically the most vulnerable to the negative impacts of climate change. Examples of geographically restricted, vulnerable ecosystems include coral reefs, mangrove forests and other coast wetlands. In fact, globally, about 20% of coastal wetlands could be lost by the year 2080 due to sea level rise.[22]

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[13] Bindoff et al. (2007)

[14] Hansen et al. (2006)

[15] Fischlin et al. (2007)

[16] Orr et al. (2005)

[17] Bindoff et al. (2007)

[18] Bindoff et al. (2007)

[19] Arctic Change Indicator Website

[20] Doney (2007)

[21] Secretariat of the Convention on Biological Diversity (2009)

[22] IPCC (2002)

23. Tropical coral reefs are the world's most biodiverse marine ecosystems and home to one-third of all described marine species.[23] According to a 2008 report by the Global Coral Reef Monitoring Network, the world has lost 19% of its coral reefs.[24] Climate change is considered to be the biggest threat to coral reefs today. Climate change will increase the severity and incidence of coral bleaching throughout tropical seas in the 21st century. Future projections indicate that the majority (98%) of the world's coral reefs will experience bleaching events at least once every five years by the end of this century.[25] Coral reefs are very likely to be affected by increasing sea surface temperature and sea level rise, damage from tropical cyclones, and decreases in growth rates due to the effects of higher carbon dioxide concentrations on ocean chemistry, combined with other stress factors such as nutrient loading and chemical pollution, making them one of the most vulnerable components of island biodiversity The impacts of mass bleaching events on coral reef biodiversity are significant and are predicted to increase as the frequency and intensity of bleaching events rises. Coral bleaching leads to the loss of reef-associated communities and species, and diminishes the productivity of fish habitat and fisheries. More information on coral bleaching and biodiversiy is available in document UNEP/CBD/SBSTTA/16/INF/11.

24. Also, in islands with cloud forest or high elevations characterized by extreme vegetation gradients, such as the Hawaiian Islands, climate change is likely to combine with past land-use changes and biological invasions to drive several species such as endemic birds to extinction.[26]

C. The risks and consequences for ecosystem services and human well-being

Agriculture, fisheries and food security

25. Small islands have traditionally depended upon subsistence and cash crops for survival and economic development, and have a particularly high dependence on plant genetic resources as well as marine and coastal resources and fisheries.

26. Projected impacts of climate change include extended periods of drought and, on the other hand, loss of soil fertility and degradation as a result of increased precipitation, both of which will negatively impact on agriculture and food security.

27. Moreover, coral reefs, mangroves, and seagrasses are important ecosystems in many small islands and are significant contributors to the economic resource base of many islands.

28. Fisheries, which contribute significantly to GDP on many islands, could suffer from the impacts of climate change which would exacerbate other anthropogenic stresses such as over-fishing. Furthermore, a recent scientific study by researchers affiliated with the World Fish Center examined the vulnerability of 132 national economies to potential climate change impacts on capture fisheries. The study found that the most vulnerable countries were those in which fisheries made a significant contribution to both the national economy as well as to local peoples' diets, and which due to low income levels, would have difficulty in adapting to climate change impacts. The inhabitants of these countries were among the poorest in the world, and were twice as reliant on fish for their dietary protein as residents of other countries in the study.[27]

Tourism

29. Tourism is a major economic sector in many islands. For those islands whose economies depend highly on tourism, the impacts of climate change on tourism resources could have significant negative

[23] Reaka-Kudla (1997)
[24] Obura et al. (2008)
[25] Donner (2009)
[26] IPCC (2007)
[27] Allison et al. (2009)

effects. For example, projected sea level rise and increased frequency and intensity of extreme climatic events can cause beach erosion, degradation of mangroves and coral reefs, and loss of land from flooding, which in turn affect tourism-related activities.

D. The contribution of island biodiversity to climate change adaptation

Ecosystem-based approaches for adaptation

30. Ecosystem-based approaches for adaptation integrate the sustainable use of biodiversity and ecosystem services into an overall adaptation strategy to help people adapt to the adverse effects of climate change. Intact ecosystems are usually better able to provide ecosystem services to support adaptation, and the conservation of such ecosystems and the restoration of degraded ecosystems is an important element of ecosystem-based adaptation.[28] Ecosystems also play an important role in protecting infrastructure and enhancing human security, especially from the negative impacts of extreme climatic events. For example, the restoration of coastal habitats such as mangroves can be a particularly effective measure against storm surges and coastal erosion. The conservation of river basins, aquifers, flood plains and associated vegetation to maintain ecosystem services functions, such as water storage and flood regulation, is another way in which island biodiversity conservation can contribute to climate change adaptation. Ecosystem-based adaptation can be more cost-effective than infrastructure or engineering options, and may generate social, economic and cultural co-benefits for island populations.

31. For example, in Papua New Guinea, a network of marine protected area was established to conserve globally significant coral reefs and associated biodiversity, and sustain fisheries that local communities depend on for food and income. Local communities manage their own protected areas in the network so that they can best protect their fisheries and benefit from additional livelihood opportunities such as eco-tourism and sport fishing.[29]

32. Another example of ecosystem-based adaptation planning, but on a regional basis, is the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security — a multilateral partnership of six countries formed in 2009 to address the urgent threats facing the coastal and marine resources of the Coral Triangle, one of the most biologically diverse and ecologically rich regions on Earth. The climate change impacts that are threatening the Coral Triangle include ocean acidification, coral bleaching, and damage from increasing occurrence of extreme weather events. To implement climate change adaptation measures, the action plan of the initiative includes regional collaborative actions, general actions to be taken in each country, and more specific actions covering a range of management scales and frameworks (e.g. establishment and management of marine protected areas; transboundary seascape management plans; integrated coastal zone management plans; marine protected area network plans),[30] with the overall objective to maintain the biodiversity and the ecosystem services provided by marine and coastal resources that are particularly critical to income, livelihoods and food security of coastal communities.

E. Assessment of the positive and negative impacts of climate change mitigation and adaptation activities on island biodiversity

33. Climate-change adaptation and mitigation can have a positive, neutral or negative impact on island biodiversity depending on the manner in which such activities are implemented and the extent to which the impacts on biodiversity are considered during planning and implementation.

34. Traditional responses to coastal erosion and flooding in islands have been the construction of hard infrastructure and engineering (e.g. sea walls, dykes, etc.). Many proposed strategies to adapt to climate change impacts in islands and coastal regions consider such approaches. However, coastal engineering

[28] Secretariat of the Convention on Biological Diversity (2009)

[29] Green et al. (2007)

[30] Secretariat of the Convention on Biological Diversity (2009) ; Coral Triangle Initiative http://www.coraltriangleinitiative.org/

often adversely impact natural ecosystems processes by altering tidal current flows, disrupting or disconnecting ecologically related coastal marine communities, disrupting sediment or nutrition flows and may cause stagnation in some contexts. Such structures may also impede successful reproduction of some species (e.g. turtles).

35. There is a wide range of forestry-related mitigation options that can potentially provide important biodiversity conservation benefits, including reducing emissions from deforestation and forest degradation, forest conservation, sustainable management of forests and enhancement of forest carbon stocks. However, the extent to which mitigation activities can deliver conservation benefits will depend on how and where these activities are implemented. The effect of different climate change mitigation options are also time dependent. For instance, reducing emissions from deforestation and forest degradation has an immediate effect whereas the mitigation effect of afforestation and reforestation will build through time.

36. Different tools to enhance the positive and minimize the negative impacts of adaptation and mitigation activities have been identified by the Second AHTEG on biodiversity and climate change. The Secretariat of the CBD also prepared a document on REDD-plus and Biodiversity (Technical Series No. 59) with a view to provide technical and scientific information to Parties in the process of designing and implementing REDD-plus in a way that does not run counter to the objectives of the Convention on Biological Diversity, but supports the implementation of the programme of work on forest biodiversity (Decision IX/5).[31]

F. Measures that enhance the adaptive potential of components of island biodiversity

37. Climate change is one of many drivers causing the loss of island biodiversity, and its impact is increasing. As such, one strategy to enhance the adaptive potential of island biodiversity is to reduce other threats while considering both current threats and those threats that are, themselves, expected to be exacerbated by climate change. For island ecosystems, the main drivers of biodiversity loss include invasive alien species, overexploitation and habitat change.[32]

38. Increasing protected area systems and improving the connectivity of protected areas and natural landscapes may also enhance the adaptive potential of island biodiversity by providing opportunities for species to adapt to climate change by migration, and to increase the probability of maintaining viable populations of species.

39. Networks of protected areas with connecting corridors provide dispersal and migration routes for species. The location and management of protected areas, including marine protected areas, needs to take into account potential climate change. Activities that can increase the resilience of these protected areas include maintaining intact natural vegetation along environmental gradients, providing buffer zones around protected areas, minimizing habitat fragmentation, conserving genetic diversity within and among populations of native species and protecting major biodiversity hotspots.[33]

40. Adaptive capacity and resilience can also be strengthened through the application of traditional knowledge and past experience of environmental changes.

41. Finally, Integrated Marine and Coastal Area Management (IMCAM) is recognized as a useful governance framework and management process for climate change adaptation planning and implementation as its holistic approach helps engage diverse stakeholders, including local governments and communities, in planning and implementation processes. It aims at reducing vulnerability to climate change by enhancing adaptive capacity and increasing resilience of both ecosystems and local

[31] Secretariat of the Convention on Biological Diversity (2011)

[32] Millennium Ecosystem Assessment (2005)

[33] IPCC (2002)

communities. The IMCAM process allows managers to take due consideration of scientific, social, political and economic factors in the development of a comprehensive management strategy. It promotes the on-ground application of ecosystem-based approaches to approach.

G. Opportunities from climate change mitigation and adaptation activities for the conservation and sustainable use of biodiversity

42. Actions taken to conserve and sustainably use biodiversity for reasons other than climate change can contribute to climate change mitigation and adaptation, and vice versa. For example, areas allocated to conserve biodiversity represent long-term stores of carbon. Forests, with an estimated 2,400 Gt of stored carbon, account for almost half the terrestrial carbon pool.[34] Intact tropical forests produce on average USD 6,120 per hectare per year in ecosystem services.[35] Therefore, forest conservation contributes to climate change mitigation.

43. Similarly, while protected areas are primarily designated for the purpose of biodiversity conservation, they have significant additional value in storing and sequestering carbon and potentially preventing future deforestation.[36]

IV. ENHANCING THE INTEGRATION OF CLIMATE CHANGE WITHIN THE PROGRAMME OF WORK ON ISLAND BIODIVERSITY

A. Appropriate monitoring and evaluation techniques, related technology transfer and capacity-building support within the programmes of work

Monitoring and evaluation techniques

44. Guidance on cost effective tools and methods to assess the threats and likely impacts of climate change faced by biodiversity in the identified vulnerable areas was compiled from a literature review conducted by the Secretariat, as well as from the Technical Series No. 10 and No. 25; and the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations.[37]

45. The IPCC technical guidelines for assessing climate change impacts identifies six steps for analysing vulnerability:

1. Definition of the problem;
2. Selection of the methods;
3. Testing the methods;
4. Selection of scenarios;
5. Assessment of biophysical and socio-economic impacts; and
6. Assessment of autonomous adjustments.

46. Tools identified in the technical guidelines include: experimentation, impact projections, empirical analogue studies, and expert judgement. To evaluate current impacts, observations and literature reviews are also useful tools.

Technology transfer

47. Under the cross-cutting issue on technology transfer, Parties to the Convention on Biological Diversity undertake to provide and/or facilitate access for and transfer to other Contracting Parties of

[34] Secretariat for the Convention on Biological Diversity and Deutsche Gesellschaft für Internationale Zusammenarbeit (giz) GmbH (2011).

[35] TEEB (2009)

[36] Secretariat of the Convention on Biological Diversity (2009)

[37] IPCC (1994)

technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.

48. With regards to enhancing the integration of climate change considerations within the programme of work on island biodiversity, such technologies could apply to adaptation and mitigation. With regards to adaptation based on the needs stated by Parties, relevant technologies may include techniques for the restoration of degraded ecosystems, tools for monitoring impacts and vulnerability, and technologies for information exchange and awareness raising. With regards to mitigation, technologies may include tools for monitoring carbon sinks and emission rates.

Capacity-building

49. With regards to capacity-building, Parties to the Convention on Biological Diversity identified two main needs (i) improved knowledge and (ii) institutional capacity building for enhanced international cooperation.

50. The need for capacity-building to enhance knowledge has also been expressed under the UNFCCC Nairobi work programme on impacts, vulnerability and adaptation to climate change, which has called for capacity building to improve bioclimatic modelling. Such models consider not only the physical impacts of climate change but also the affects of such impacts on biological processes and the functioning of ecosystems. Additional capacity building has been requested to improve the down-scaling of climate models.

B. Critical knowledge needed to support implementation

51. The fourth assessment report of the IPCC identified several sources of uncertainties concerning the links between climate change and biodiversity, which also apply to island biodiversity, including:

(a) The lack of geographic balance in data and literature on observed changes in natural and managed systems, with marked scarcity in developing countries. Possible reasons for this imbalance are lack of access by IPCC authors, lack of data, research and published studies, lack of knowledge of system sensitivity, differing system responses to climate variables, lag effects in responses, resilience in systems and the presence of adaptation;

(b) Analysing and monitoring changes in extreme events, including drought, tropical cyclones, extreme temperatures and the frequency and intensity of precipitation, is more difficult than for climatic averages as longer data time-series of higher spatial and temporal resolutions are required;

(c) Effects of climate changes on human and some natural systems are difficult to detect due to adaptation and non-climatic drivers.

52. The Second AHTEG on biodiversity and climate change recognized a number of gaps in knowledge linked to a lack of complete and comprehensive models linking biodiversity and climate change and gaps in associated, biological, ecological and climatic data. Identified needs or data gaps include:

(a) Spatially explicit biodiversity data;

(b) Readily available downscaled probabilistic projections at appropriate spatial scales, including projections of extreme events;

(c) Improved predictive ability of bioclimatic models;

(d) Coupled human-natural systems models; and

(e) The establishment of multi-purpose monitoring programs that include the impacts of climate change on biodiversity.

53. Document UNEP/CBD/SBSTTA/16/INF/26 contains an introduction to models and modelling concepts and examples of projects and programmes modelling biodiversity – climate change interactions. The note presents examples of biophysical models, integrated assessment tools, Bioclimatic Envelope/Ecological Niche Models and biodiversity indicator models, and highlights their respective benefits and limitations.

54. Technical Series No. 10 and No. 25 also identify key research needs, including additional research on:

(a) The relationship between biodiversity and ecosystem structure and the delivery of ecosystem services;

(b) Which ecosystem functions are most vulnerable to species loss;

(c) Projected climate change impacts on soil biodiversity;

(d) The effects of energy activities on biodiversity; and

(e) Indicators.

C. The ecosystem-approach principles and guidance

55. Since the ecosystem approach takes a broad perspective to management, it has been identified as a potential methodology through which the multiple impacts from climate change, including on biodiversity, can be reflected in comprehensive and responsive adaptation planning.

56. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.[38]

57. Islands typically contain closely connected ecosystems. Island ecosystems are also important for their cultural, spiritual, educational and recreational values. Therefore, the ecosystem approach is particularly relevant to islands. Indeed, the programme of work on island biodiversity, in decision VIII/1, acknowledges that islands are microcosms that offer great scope for the application, testing and refinement of a wide range of conservation tools and approaches, including the ecosystem approach, and that implementation of this programme of work should take into account the ecosystem approach as the logical planning and management tool for integral island policies.

58. The principles of the ecosystem approach can be applied, for example, for the planning, designing and establishment of climate resilient protected areas. Some island Parties have reported, in their CBD national reports, the establishment of "ridge to reef" protected areas (e.g. Micronesia and Samoa) as a climate change adaptation activity. The "ridge to reef" approach considers the entire island, coast, near shore and ocean as one entity. It focuses on the overall resilience of the entire set of ecosystems and examines upstream impacts on downstream and coastal processes. This approach can strengthen climate change adaptation as it allows for the connection of migration corridors.

[38] Secretariat of the Convention on Biological Diversity (2009)

Annex

EXAMPLES OF CLIMATE CHANGE ADAPTATION AND MITIGATION ACTIVITIES RELATED TO THE ISLAND BIODIVERSITY PROGRAMME OF WORK

Antigua and Barbuda

Sustainable land use practices for the conservation of soil and water resources and rehabilitation of the Body Ponds watershed on Antigua

The project aims at reducing the threats to ecosystem integrity related to unsustainable land use (loss of native vegetation, monoculture, overgrazing, spread of invasive species, uncontrolled fires). These threats reduce the ability of the island of Antigua to cope with cyclical weather patterns, which are likely to worsen with climate change.

The purpose of this project is to demonstrate soil and water conservation strategies to restore / maintain watershed functionality (through promotion of alternative agro-pastoral techniques, invasive species management (Citronella sp), and habitat restoration) within the Body Ponds watershed.

For more information, refer to: http://gefantigua.org/sirmm-demonstrations/sirmm-demo-1-rehabilitation-of-the-body-ponds-watershed-2/

Fiji

Mangrove Ecosystems for Climate Change and Livelihoods (MESCAL)

Under the Pacific Mangrove Initiative (PMI), the MESCAL project was developed to address key challenges to mangrove and coastal ecosystems management and conservation. The overall goal of this project is to help Pacific Islanders build resilience to the potential consequences of climate change and variability on coastal areas, while supporting and enhancing livelihoods.

The project MESCAL Fiji addresses mangrove management (policies and regulations, mangrove management plans and national level database of the country) and community awareness and capacity building through governance and capacity building on mangroves and climate change adaptation.

For more information, refer to:
http://www.iucn.org/about/union/secretariat/offices/oceania/oro_programmes/oro_water/oro_water_mescal/oro_waterandwetlands_mescal_fiji.cfm

Mauritius

Africa Adaptation Project: Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Mauritius

The Africa Adaptation Project (AAP) promotes informed and appropriate adaptation decisions and practices, and development that is sustainable and resilient to threats, including climate change.

Mauritius is one of the 20 countries participating in the AAP. Some of the planned outcomes include:

- Inundation maps created to identify vulnerable areas to natural disaster;
- Adequate early warning system developed and implemented to reduce vulnerability;
- Institutional mapping process completed in several sectors to see how different stakeholders are interacting, how resources are being allocated, and where there is potential for collaboration;
- On-ground adaptation pilots supported and implemented by the Adaptation Unit;
- Climate change knowledge and lessons learned disseminated; and

- Awareness raising activities completed.

For more information, refer to: http://www.undp-aap.org/countries/mauritius

Solomon Islands

Poverty Alleviation, Mangrove Conservation and Climate Change; Carbon Offsets as Payments for Mangrove Ecosystem Services in Solomon Islands

Mangroves are key coastal ecosystems that provide valuable goods and services including water quality control, nursery habitats and storm protection. Mangroves also sequester significant amounts of atmospheric carbon. Therefore, their conservation and restoration play an important role, not only for climate change adaptation, but also mitigation.

The goal of the project is to develop a 'roadmap' for the Solomon Island government and local communities to navigate through the options and methodologies for developing a mangrove carbon offset system for Solomon Island mangroves.

As the first project in the Solomon Islands to explore opportunities for obtaining carbon credits for mangrove protection and rural livelihood diversification, it is expected to serve as a practical blueprint for protecting the estimated 50,000 hectares of mangroves nationwide.

For more information, refer to: http://www.worldfishcenter.org/our-research/payments-mangrove-ecosystem-services

Tonga

Mitigating Climate Change Impacts in Ha'apai

The Ha'apai Island group is recognized to be more vulnerable to the impacts of climate change compared to other parts of Tonga. The project's objective is to empower Tongan communities in Lifuka and Foa islands to mitigate and adapt to climate change impacts.

The project will adopt an integrated approach for community empowerment, communication and awareness, and demonstration of best mitigation and adaptation practices for communities. The project will also involve the expansion of tree nurseries to cater for coastal reforestation and a community mini-project scheme focusing on village-based protection and replanting of endangered cultural, fruit, medicinal, and coastal trees. It is envisaged that this project will generate lessons learned for replication in other island groups in Tonga.

For more information, refer to: http://www.tcdt.to/cca.html

Trinidad and Tobago

The Nariva Wetland Restoration and Carbon Sequestration

The objective of the Nariva Wetland Restoration and Carbon Sequestration Project in Trinidad and Tobago is to restore and conserve the Nariva wetland, recognizing that it provides important ecosystem services such as carbon sequestration. The first component of the project is carbon sequestration through afforestation and reforestation of selected areas of the Nariva wetland ecosystem. The second component is methane mitigation through restoration of surface hydrology at Nariva. This component will be achieved through the restoration of the natural drainage regime.

For more information, refer to:
http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P094948

REFERENCES

Allison, E.H., A. Perry, M. Badjeck, N. Adger, K. Brown, D. Conway, A. Halls, G. Pilling, J.. Reynolds, N. Andrew and N. Dulvy (2009). Vulnerability of national economies to the impacts of climate change on fisheries. *Fish and Fisheries*. 10(1).

Arctic Change Indicator Website. Retrieved March 19, 2012, from http://www.arctic.noaa.gov/detect/index.shtml

Bindoff, N.L., J. Willebrand, V. Artale, A, Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D., Talley and A. Unnikrishnan (2007). Observations: Oceanic Climate Change and Sea Level. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S.,D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Coral Triangle Initiative. Retrieved March 6, 2012, from http://www.coraltriangleinitiative.org/ .

Doney, Scott (2007). Effects of Climate Change and Ocean Acidification on Living Marine Resources. Written testimony presented to the U.S. Senate Committee on Commerce, Science and Transportation's Subcommittee on Oceans, Atmosphere, and Coast Guard. May 10. http://www.whoi.edu/page.do?pid=8916&tid=282&cid=27206

Donner, S. 2009. Coping with Commitment: Projected Thermal Stress on Coral Reefs under Different Future Scenarios. *PLoS ONE* 4: e5712.

Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff and A.Watkinson, 2005: Predicting the impact of sea level rise on Caribbean sea turtle nesting habitat. *Conserv. Biol.*, **19**, 482-491.

Fischlin, A., G.F. Midgley, J.T. Price, R. Leemans, B. Gopal, C. Turley, M.D.A. Rounsevell, O.P. Dube, J. Tarazona, A.A. Velichko (2007). Ecosystems, their properties, goods, and services. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, 211-272.

Gilman, E., H. Van Lavieren, J. Ellison, V. Jungblut, L.Wilson, F. Ereki, G. Brighouse, J. Bungitak, E. Dus, M. Henry, I. Sauni, M. Kilman, E. Matthews, N.Teariki-Ruatu, S. Tukia and K.Yuknavage, 2006: Pacific Island mangroves in a changing climate and rising sea. UNEP Regional Sea Reports and Studies 179, United Nations Environment Programme, Regional Sea Programme, Nairobi, 58 pp.

Green, A., Lokani, P., Sheppard, S., Almany, J., Keu, S., Aitsi, J., Warku Karvon, J., Hamilton, R and G. Lipsett-Moore (2007). Scientific Design of a Resilient Network of Marine Protected Areas. Kimbe Bay, West New Britain, Papua New Guinea. TNC Pacific Island Countries Report No. 2/07.

Hansen, J., M. Sato, R. Ruedy, K. Lo, D.W. Lea, and M. Medina-Elizade (2006). Global temperature change, *Proc. Nat. Acad. Sci*. USA, 103, 14288-14293, 10.1073.

IPCC (1994). T.R.Carter, M.L.Parry, H.Harasawa, S.Nishioka. IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations. Department of Geography, University College London, UK and the Center for Global Environmental Research, National Institute for Environmental Studies, Japan. pp 59

IPCC (2002) Technical Paper V: Climate Change and Biodiversity, H Gitay, A Suárez, RT.Watson, DJ Dokken (Eds). IPCC, Geneva, Switzerland. pp 85.

IPCC (2007) Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, pp104.

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

Obura, D., Tamelander J., O., & Linden (2008). Coastal oceans research and development in the Indian Ocean: Status Report 2008.

Orr, J.C., V.J. Fabry, O. Aumont et al. (2005) Anthropogenic ocean acidification over the twenty-first century and its impact on marine calcifying organisms, *Nature*, 437, 681-686.

Reaka-Kudla, M.L. (1997) Global biodiversity of coral reefs: a comparison with rainforests. In: Reaka-Kudla, M.L., Wilson, D.E. (eds.) Biodiversity II: Understanding and Protecting Our Biological Resources. Joseph Henry Press

Secretariat of the Convention on Biological Diversity (2009). Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Montreal, Technical Series No. 41, pp 126.

Secretariat of the Convention on Biological Diversity (2011). REDD-plus and Biodiversity. Montreal, Technical Series No. 59, pp 65.

Secretariat for the Convention on Biological Diversity and Deutsche Gesellschaft für Internationale Zusammenarbeit (giz) GmbH (2011). Biodiversity and Livelihoods: REDD-plus Benefits. Montreal and Eschborn. Pp41.

TEEB (2009). The Economics of Ecosystems and Biodiversity: Climate Issues Update. September 2009.
