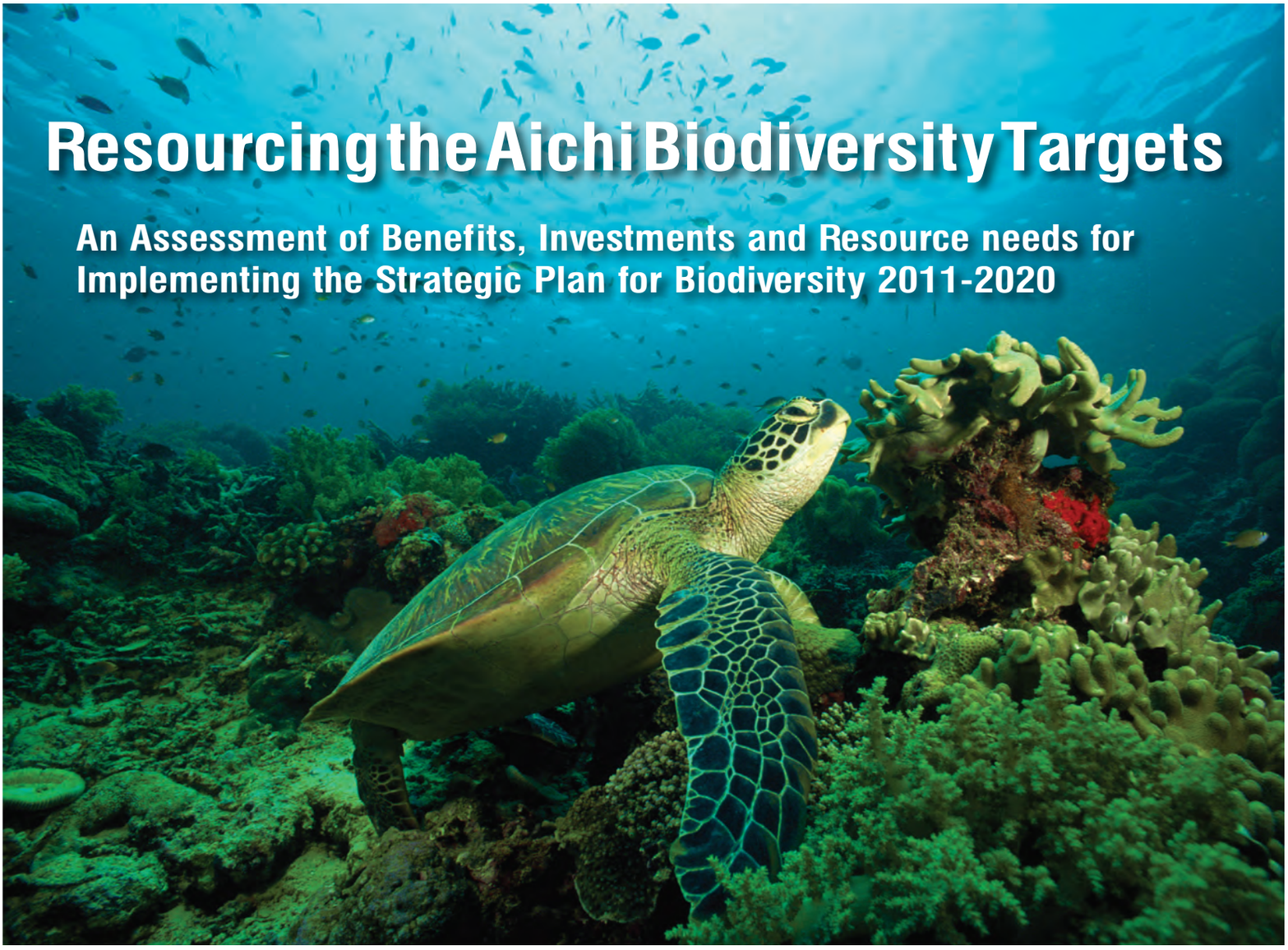
Resourcing the Aichi Biodiversity Targets

An Assessment of Benefits, Investments and Resource needs for Implementing the Strategic Plan for Biodiversity 2011-2020



Second Report of the High-Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020

UNEP

Convention on Biological Diversity

2011-2020 United Nations Decade on Biodiversity

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The opinions expressed and arguments employed herein do not necessarily reflect the official views of the observer governments and organisations to the High Level Panel, including where relevant their member countries.

Department for Environment Food & Rural Affairs

Japan Biodiversity Fund 生物多様性日本基金

NORWEGIAN MINISTRY OF CLIMATE AND ENVIRONMENT

Forewords

"The global assessment, which was welcomed by the twelfth meeting of the Conference of Parties in Pyeongchang in October 2014, provides an unambiguous message that nature-based investments will be an essential component of the movement towards inclusive green economies. The report highlights, for example, that establishing protected areas will create new opportunities for tourism business. This message resonates well with our national policy to achieve both economic development and environmental conservation, and I encourage all member states to consider its findings and the implementation of its recommendation."

Yoon Seong-Kyu, Minister of Environment of the
Republic of Korea and President of COP 12

"The report of the High-Level Panel on the Global Assessment of Resources for Achieving the Aichi Biodiversity Targets has well documented the significant co-benefits, which investment in biodiversity will deliver for sustainable development. It is important to recognize that about one-third of the total wealth of low-income countries is dependent on natural capital, which the panel has rightly described as the 'GDP of the poor'. I encourage countries to consider the key messages of the report in the context of the deliberations of the third International Conference on Financing for Development and its preparatory process".

George Talbot, Ambassador and Permanent Representative of
the Republic of Guyana to the United Nations and Co-facilitator
of the Financing for Development process

"The report from the Convention on Biological Diversity provides practical examples on the positive link between investments in nature and poverty eradication. I encourage member states to consider the data and analysis from the Convention's high-level panel of experts in the preparations for the Third International Conference on Financing for Development".

Geir O. Pedersen, Ambassador and Permanent Representative
of Norway to the United Nations and Co-facilitator of
the Financing for Development process

"The SCBD High-Level Panel has very ably demonstrated the benefits and co-benefits of achieving the Aichi Biodiversity Targets for a variety of sectors. It shows that these benefits are likely to significantly outweigh costs. This positive message from the Panel of experts is in line with UNEP's overall assessment on environmental issues that long-term benefits of action frequently outweigh the short-term costs of implementation. The report also recognizes that securing these benefits and synergies requires the development of coherent political and institutional frameworks, including strong political will, in all nations".

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

"This report provides an important message to the international community negotiating post-2015 sustainable development targets that biological diversity underpins ecosystem functioning and the provision of ecosystem services essential for human well-being. It provides for food security, human health, the provision of clean air and water; it contributes to local livelihoods, and economic development, and is essential for the achievement of the sustainable development goals, including poverty reduction".

Wu Hongbo, Under-Secretary General for Economic and Social Affairs, Secretary General of the Third International Conference on Financing for Development

"At the twelfth meeting Conference of the Parties to the Convention on Biological Diversity, Parties encouraged the use and implementation of the findings and recommendations of the second report of the High-level Panel on the Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020. The findings of the report on the cost of achieving the Aichi Biodiversity Targets should not be considered by Parties as an additional burden, but an investment whose long-term social and economic benefits significantly outweigh the cost. The magnitude of funding requirements depends on a variety of factors, in particular how effectively the Aichi Biodiversity Targets are mainstreamed into larger development goals. The High-Level Panel report has a timely message for Governments and other economic actors to reallocate resources to achieve the best outcome for biodiversity and sustainable development".

Braulio Ferreira De Souza Dias, Executive Secretary, Convention on Biological Diversity

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1 Introduction

The continued work of the High-Level Panel on Global Assessment of Resources for implementing the Strategic Plan for Biodiversity 2011-2020 is intended to support discussions and decisions on resource mobilisation and innovative financing in the lead up to and at the twelfth meeting of the Conference of the Parties (COP12) of the Convention on Biological Diversity. This report builds on the global assessment of resources presented in the first High-Level Panel report (HLP, 2012) and its contribution to the understanding of the global resources required for the Strategic Plan and the Aichi Biodiversity Targets. It identifies and analyses the benefits of delivering the Aichi Targets, their investment and resource requirements, how these social, economic and environmental benefits and investments align with existing policy, and how they can be delivered in the most cost-effective manner. As such the report provides advice for improving the implementation of the Strategic Plan for all Parties.

It is understood that in order to achieve the mission of the Strategic Plan[1] and to meet the Aichi Biodiversity Targets, a significant increase in resources (financial, institutional, human and technical) will be required. These resources will need to be mobilised at different scales and from a variety of sources, including existing as well as new and innovative sources. The Strategy for Resource Mobilisation, adopted at COP9, recognises that funding for biodiversity has been insufficient to address the rate of biodiversity loss and that the lack of sufficient financial resources continues to be one of the main obstacles to achieving the Convention's objectives. A number of preliminary targets were subsequently agreed at COP11 to provide an overall substantial increase in total biodiversity-related funding for the implementation of the Strategic Plan for Biodiversity 2011–2020 from a variety of sources (decision XI/4, para. 7)[2].

COP decisions and mandate of the High-Level Panel

The initial establishment of the High-Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020 was welcomed by the fourth meeting of the Ad Hoc Open-Ended Working Group on Review of Implementation of the Convention (WGRI 4, recommendation 4/2), which invited the Panel to report to COP 11. Following discussion of the High-Level Panel report at COP 11, the COP invited the panel, in collaboration with other relevant initiatives that could provide a more bottom-

[1] The mission of the Strategic Plan is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication. To ensure this, pressures on biodiversity are reduced, ecosystems are restored, biological resources are sustainably used and benefits arising out of utilization of genetic resources are shared in a fair and equitable manner; adequate financial resources are provided, capacities are enhanced, biodiversity issues and values mainstreamed, appropriate policies are effectively implemented, and decision-making is based on sound science and the precautionary approach."

[2] The following are the preliminary resource mobilisation targets, which are to be considered mutually supportive but independent:

a) Double total biodiversity-related international financial resource flows to developing countries, in particular least developed countries and small island developing states, as well as countries with economies in transition, by 2015 and at least maintaining this level until 2020, in accordance with Article 20 of the Convention, to contribute to the achievement of the Convention's three objectives, including through a country-driven prioritization of biodiversity within development plans in recipient countries, using the preliminary baseline referred to in decision XI/4, para. 6;
b) Endeavour for 100%, but at least 75%, of Parties to have included biodiversity in their national priorities or development plans by 2015 and have therefore made appropriate domestic financial provisions;
c) Endeavour for 100%, but at least 75%, of Parties provided with adequate financial resources to have reported domestic biodiversity expenditures, as well as funding needs, gaps and priorities, by 2015, in order to improve the robustness of the baseline and to refine the preliminary targets, as appropriate;
d) Endeavour for 100%, but at least 75%, of Parties provided with adequate financial resources to have prepared national financial plans for biodiversity by 2015, and that 30% of those Parties have assessed and/or evaluated the intrinsic, ecological, genetic, socioeconomic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components.

up approach, to continue its work with a broadened composition (of additional Panel members with a regional balance) and to report back on the results of its work to COP 12 (decision XI/4).

The main objectives (Terms of Reference) of the High-Level Panel are to:

1. Develop an assessment of the benefits of meeting the Aichi Biodiversity Targets, examining both direct biodiversity benefits and wider benefits to society that result from the investments and policy developments required;

2. Assess the range of the costs of implementing the activities needed to achieve the targets, taking into account the further work proposed in the High-Level Panel report to COP-11;

3. Identify opportunities to secure the benefits most cost effectively through actions in both the biodiversity sector and across economies as a whole that can mobilize / make better use of resources, to deliver greatest progress towards meeting the Aichi targets.

In its second phase of work, the Panel has built upon the findings of the first report by initiating a more bottom-up approach that takes greater account of regional evidence and places more emphasis on the costs and benefits of meeting the targets, cost-effective means of reaching objectives, and synergies with other policy agendas.

Summary of the findings of the first High-Level Panel

The first High-Level Panel report (HLP, 2012) presented a global assessment of the costs of meeting the Aichi Biodiversity Targets by 2020, estimating that between US$150 billion and US$440 billion per year would be required to implement the twenty Targets. The

Box 1 Key messages from the first phase of the High-Level Panel

1. Implementation and delivery of the Targets requires the development of an appropriate and coherent political and institutional framework and strong political will, particularly at the national and regional levels;

2. Investment in biodiversity and natural capital will deliver significant co-benefits for sustainable development;

3. Existing evidence suggests that benefits of meeting the Targets are likely to significantly outweigh costs;

4. There are clear differences in the relative scale of investment required to deliver the various Targets. In addition, the investment needed to deliver a Target is not necessarily correlated to its importance;

5. Many factors affect the magnitude of the estimates of the investments needed to achieve each of the Targets. These include the scope of the activities to be undertaken and associated investment opportunities and the potential synergies among Targets as well as uncertainties arising from limitations in data and methodologies;

6. There are many inter-linkages and co-dependencies to consider both between the Targets themselves, and between the Targets and other national policy goals;

7. Funding from a diverse range of international and national sources, and across different policy areas is required to secure the full range of economic and social benefits to be gained from meeting the Aichi Targets;

8. Further research is vital to help improve and refine these estimates.

Panel acknowledged the range of uncertainties that accompanies this estimate, and recognised that further research was vital to help develop and refine these estimates. It also highlighted that the resource needs were not a "bill" for biodiversity, but called for a change in the way resources are allocated in our economies to get the best outcomes for biodiversity and sustainable development. The report added that a variety of factors affect the magnitude of the funding requirements. In particular, inter-linkages and synergies between Targets and other goals mean that the approach, resourcing and effectiveness of the delivery of any one Target may influence the investment needs of another. The High-Level Panel highlighted some of the significant benefits of delivering the targets, as well as co-benefits to other sectors, and concluded that benefits secured through implementing the Aichi Targets are likely to significantly outweigh costs. However, the High-Level Panel also recognised that there is a need for the development of an appropriate and coherent political and institutional framework, including strong political will, in all nations in order to secure these benefits and synergies.

2 Organisation of Work

2.1 Working arrangements of the High-Level Panel

The High-Level Panel and its underpinning research and activities are co-sponsored by the governments of the UK, India, Norway, Japan and Brazil. Representatives from these governments, along with UNEP, UNDP, OECD, the World Bank, the GEF and the CBD Secretariat, have thus been closely engaged in facilitating the work of the Panel.

The High-Level Panel met three times on 30-31 May 2013 (Trondheim, Norway), 2-4 December 2013 (Chennai, India) and on 14-15 April 2014 (Brasilia, Brazil). Meetings reviewed progress on the preparation of the report and its findings, and feedback received during its review.

2.2 Organisation of the research

The CBD Secretariat commissioned a project for research to support the second phase of the work of the High-Level Panel. This work was contracted to the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and ICF International, who then commissioned and managed the regional research.

The research was organised so as to collect bottom-up evidence from different countries, regions and initiatives at different geographical scales, through six regional research consultancies. This evidence supported analysis of the inter-linkages between targets and with broader policy agendas, as well as the costs and benefits of meeting individual targets at these different levels. This report draws on the regional reports, supplemented by global analyses, and presents synthesised evidence and case studies from the regional assessments. The High-Level Panel has drawn ten Key Messages from its review, which are then used to structure the evidence presented. In addition, in order to deliver a long-term, stable and predictable increase in resources for meeting the Aichi Targets, and the associated Vision for 2050, the High-Level Panel makes a series of recommendations which aim to highlight the actions required to ensure the values of biodiversity are reflected in plans and decisions throughout our economies and societies.

3 Methodology

3.1 Research questions

Building on its Terms of Reference, the Panelagreed a series of research questions (Box 2) that it would seek to answer through its work and which would form the basis for its report to COP 12. In answering these questions, the High-Level Panel has been informed by regional research projects, collating evidence from six regions[1] in response to the research questions. Methodological guidelines were established for regional researchers to ensure consistency and coherence in approach across the different regional

[1] Regions were determined using the geographical groupings of the UN Statistics Division http://unstats.un.org/unsd/methods/m49/m49regin.htm. Regions were therefore Africa, Asia , Australasia and the Pacific, Europe, Latin America and the Caribbean, and North America

3.2 Sources of evidence

The research incorporated desk-based analysis of secondary data as well as analysis of quantitative and qualitative primary data from country consultations by the CBD Secretariat, consultation with various organizations (both within and outside the UN system) and bottom-up initiatives at various levels, and other sources.

Sources of evidence varied between the questions, countries and regions but included

- Academicand research papers;
- Government studies;
- NBSAPs;

- Country submissions to CBD on resource requirements;
- Regional studies (e.g. EU, ADB);
- TEEB country studies;
- International organisations (OECD, UNEP, UNDP, World Bank and others);
- International programmes (e.g. GEF);
- Multi-country assessments (e.g. BIOFIN, WAVES, Natural Capital Project);
- Global assessments (e.g. GBO-4);
- NGO assessments;
- International databases (e.g. EVRI);
- Unpublished data and assessments by a range of the above stakeholders and initiatives.

3.3 Evidence gaps and limitations

The Panel encountered a number of significant challenges in compiling the evidence needed to address its terms of reference and the research questions set. The most significant issues were:

- **Specific evidence relating to the Aichi Targets.** While the review found many hundreds of studies relating to the costs and benefits of action for biodiversity and ecosystems,

very few referred specifically to the Aichi biodiversity targets. However, more studies have addressed issues that are relevant to specific Aichi Targets (e.g. protected areas – Target 11; sustainable fisheries – Target 6; Invasive Alien Species – Target 9). In conducting its review the Panel has therefore considered both specific evidence relevant to the Aichi Targets, and more general information which can be used to draw inferences about the relevance to the Targets.

- **Examples at different geographical scales.** The available evidence covers a range of geographic scales from site specific studies to local analyses, national assessments, regional reviews and global studies. In general there have been few national and regional level reviews to inform the assessment of the benefits and costs of meeting the Targets. Local studies tend to be more plentiful, but need to be treated carefully with regard to their representativeness and wider interpretation. The Panel has therefore faced challenges, within the time available, in piecing together variable evidence at these different levels, and considering the implications for the research questions.

- **Variations in evidence between ecosystems and biodiversity actions.** The evidence base for different ecosystems and for different types of actions varies considerably in its breadth and depth. In general evidence is relatively plentiful for forests, coral reefs and mangroves, but less abundant for grassland, scrubland and desert ecosystems. There is richer evidence for certain Aichi Targets (particularly Target 11 – protected areas, but also 12 – species conservation, 5 – conservation of forests and wetlands and 10 – coral reefs) than others such as Targets 1-4 and 17-20, which relate to broader policy frameworks and enabling actions.

- **Variations in evidence for the different research questions.** There are also differences in the available evidence between the research themes addressed by the Panel. For example, many studies provide examples of the benefits and costs of biodiversity actions, but relatively few are helpful in assessing how the Aichi Targets might be delivered most cost effectively.

- **Variations in the quality and robustness of the available information.** The Panel's review has drawn on a range of different sources, which range from peer reviewed articles to government reports, policy studies and publications by international organisations and NGOs. In general these sources vary in their quality and robustness, and critical assessment has been necessary to ensure the reliability of the supporting information that the Panel presents in this report.

The Panel's report has benefited from the inputs of three peer reviewers, who have provided helpful comments on the available evidence and its interpretation.

Overall, the Panel has found that, by drawing on a range of sources and piecing together information at different levels and for different themes, it has been able to compile a large body of information to help it address its terms of reference, but that there are inevitable gaps and areas where more specific evidence would be helpful. Some of these are highlighted in the Panel's recommendations at the end of this report.

Box 2 Research questions

1. Benefits:
   a) What will be the benefits of delivering the Aichi Targets?
   b) What evidence is there of the nature, scale and value of these benefits, at national and international levels?

2. Investment needs:
   a) What types of investments and activities are needed to deliver the Aichi targets and to secure these benefits?
   b) Where would these investments be best directed or focused?
   c) Which Targets will these investments help to meet, and what are the synergies and overlaps between Targets?
   d) What types of on-going annual expenditures will be required?
   e) How do the types of investments and ongoing expenditures identified compare to those identified in the first phase of the HLP research?

3. Resource requirements:
   a) What evidence is there of resource needs at the project and country level?
   b) How does this evidence compare with the analysis presented in the HLP's report?
   c) What evidence is there for current allocations relative to needs?
   d) What are the implications for the resources required to deliver the targets, individually and collectively?

4. Policy alignment and development:
   a) How do the identified investment needs and the benefits they will achieve align with other policy agendas, such as the Post-2015 UN Development Agenda and the Sustainable Development Goals?
   b) To what extent can we identify synergies and opportunities for joint delivery at the country and programme level?
   c) What are the implications for the overall resource requirements to meet the Aichi Targets, and the degree to which additional resources need to be targeted to them?
   d) To what extent can improvements in governance, institutional and policy development at the country level contribute in a cost-efficient manner to deliver actions to achieve the Targets?

5. Cost effectiveness:
   a) How can the Aichi Targets be delivered at least cost, taking account of the synergies between the targets and the investments required, the sequencing of actions and the synergies with other policy agendas?
   b) What evidence is there of the cost effectiveness of different investments, taking account of biodiversity gain and contribution to the Targets relative to cost?
   c) What are the implications for the sequencing and/or prioritisation of investments in moving towards achieving the Targets?

6. Benefits and costs:
   a) What does the evidence as identified above tell us about the balance between the benefits and costs of meeting the Targets?
   b) How can this evidence be used to make the case for the investments required?

4 Assessment of Benefits, Investments and Resource Needs of Achieving the Aichi Targets

4.1 Key Message 1:

Meeting the Aichi Targets will deliver substantial benefits to people and to economies across the world

Assessments at the global, regional, national and local levels all highlight the substantial values of the essential provisioning, regulating, cultural and supporting services that ecosystems provide, and the benefits of actions for the conservation and sustainable use of biodiversity, and for restoration of degraded ecosystems.

There is strong evidence of the benefits of biodiversity action for society across a wide range of Aichi targets, for all types of ecosystems and for all regions of the world.

A major part of the underlying rationale for the Strategic Plan for Biodiversity and the Aichi Biodiversity Targets is that

"*Biological diversity underpins ecosystem functioning and the provision of ecosystem services essential for human well-being. It provides for food security, human health, the provision of clean air and water; it contributes to local livelihoods, and economic development.., and is essential for the achievement of the Millennium Development Goals, including poverty reduction.*"

The evidence base on the benefits to human well-being of the conservation and sustainable use of biodiversity has expanded greatly in recent years.

The TEEB (the Economics of Ecosystems and Biodiversity) global assessment reviewed evidence of benefits from around the world, and has stimulated a series of further analyses and reviews of benefits and costs at regional and national level. As well as having intrinsic value, biodiversity plays a vital role in supporting the world's ecosystems and the services they provide. Global assessments of the benefits of halting biodiversity loss rely on substantial extrapolations and are methodologically challenging and controversial. While the robustness of global estimates can be questioned, and the different definitions and methodologies employed by different assessments lead to wide variations in estimates, they do highlight the substantial value of the benefits of halting biodiversity loss (Box 3).

The loss of ecosystem services is costing us many billions of dollars annually

There is evidence that pressures on ecosystems are having adverse effects on people and businesses across the world, and that a failure to halt ecosystem service decline will have increasingly adverse economic effects. For example, Braat and ten Brink (2008) found that the costs of policy inaction with respect to a failure to halt biodiversity decline would give rise to increasing and cumulative economic losses, which could grow to a value of $14 trillion per annum by 2050, equivalent to 7% of world GDP. Costanza *et al.* (2014) estimated the annual global value of ecosystem services at US$125 trillion in 2011. The authors estimated that global land use changes between 1997 and 2011 have resulted in a loss of ecosystem services of between US$4.3 and US$20.2 trillion per year.

There is growing evidence that shows ecosystem degradation is already having adverse economic effects at the national level, including in the poorest regions of the world. Box 4illustrates the effects of unsustainable natural resource use and ecosystem degradation on the economy of Malawi and the cumulative losses of ecosystem services from deforestation of montane forests in Kenya.

Achieving the Aichi Targets will help to maintain the essential and valuable services that ecosystems deliver across the world

Regional evidence helps to illustrate the value of different ecosystem services at different sub-global scales.

Annex Table A1 gives examples of the different services delivered by ecosystems in different parts of the world. The figures in the table demonstrate the substantial value of a range of provisioning services (e.g. fresh water), regulating services (e.g. coastal protection) and cultural services (recreation,

Box 3 Global estimates of the value of benefits from protecting biodiversity

- Balmford *et al*. (2002) estimated that the failure to protect biodiversity leads to the loss of natural services worth US$140 billion a year, and that developing a global network of nature reserves on land and at sea would cost about US$45 billion a year to maintain, while protecting ecosystem services worth between US$4,400 billion and US$5,200 billion annually.
- Another global study examining the cost of policy inaction (Braat and Ten Brink, 2008) found that a failure to halt the loss of biodiversity could result in annual losses in ecosystem services worth $14 trillion per annum by 2050, equivalent to 7% of world GDP.
- The recent TEEB Quantitative Assessment (Hussein *et al.* 2012) modelled the benefits of a number of global change scenarios and estimated that a "reduced deforestation scenario" could deliver annual net benefits of US$183 billion by 2030, as a result of the high per hectare values estimated for forest biomes. Other scenarios involving increased agricultural productivity and dietary changes could also deliver substantial net benefits.
- A 2007 study found that the total value of ecosystem services and products provided by the world's coastal ecosystems, including natural (terrestrial and aquatic) and human-transformed ecosystems, added up to US$25,783 billion per year (Martinez *et al*. 2007).
- A recent paper estimated the aggregate global value of ecosystem services at US$125 trillion in 2011 (Costanza *et al*. 2014).
- As well as providing direct benefits to people and economies, action for ecosystems also creates new market opportunities for green products and services. For example, the TEEB Synthesis report (TEEB 2010) cited estimates that global sales of organic food and drink have recently been increasing by over US$5 billion a year, reaching US $46 billion in 2007; the global market for eco-labelled fish products grew by over 50% between 2008 and 2009; and ecotourism is the fastest-growing area of the tourism industry with an estimated increase of global spending of 20% annually.

Box 4 Costs of unsustainable natural resource use and ecosystem degradation in Malawi and Kenya

In Malawi, there is compelling evidence that unsustainable natural resource use leads to increased poverty. It has been estimated that unsustainable natural resource use costs the equivalent of 5.3% of national GDP each year. This implies that Malawi might gain US$191 million per year if resources were used sustainably. The largest costs result from the impact of soil degradation on agricultural productivity, the loss of fuel as a result of deforestation around urban centres, unsustainable fishing and reduced economic activity caused by indoor air pollution (Yaron *et al*. 2011).

In Kenya, the loss of montane forests amounted to about 50 000ha over the period 2000-2010, bringing economic benefits of approximately US$16 million per year. However, by 2010, the cumulative negative effect of deforestation on the economy through reduction in regulating services was an estimated US$42.5 million per year, more than 2.8 times the cash revenue of deforestation. The reduction in dry-season river flows reduced agricultural output by US$31 million in 2010, and lowered hydropower generation by US$0.14 million. Increased siltation and nutrients from degraded land reduced inland fish catches by US$1.0 million and increased the cost of water treatment for potable use by US$2.2 million. Incidence of malaria as a result of deforestation was estimated to have cost US$4.6 million by 2010 in lost labour productivity. The above-ground carbon storage value forgone through deforestation was estimated at US$4.0 million in 2010 (UNEP 2012a). Taking into account interdependencies between sectors, the reduction in the value of regulating services due to deforestation amounted to US$68 million in 2010, which is 4.2 times higher than the actual cash revenue of US$16 million (UNEP 2012b; Crafford *et al*. 2012).

tourism as well as non-use values) derived from ecosystems.

Annex Table A2 presents evidence of the value of services delivered by different types of ecosystems. The strongest evidence relates to the value of services delivered by particular types of ecosystems, many of which are addressed specifically by the Aichi Targets, for example, forests, mangroves, wetlands and coral reefs (Box 5).

Box 5 Value of ecosystem services delivered by coral reefs (Aichi Target 10)

Coral reefs are one of the ecosystems with the highest level of biodiversity, and, though they cover only 0.2% of the world's oceans contain about 25% of marine species. They provide habitat to a wide range of fish and invertebrate species, sustaining the livelihood of millions of people. It is estimated that a well-managed reef in the Indian and Pacific Oceans can provide between 5 and 15 tons of seafood per square kilometre per year. In addition, coral reefs provide a wide range of ecosystem services: they represent a major tourist attraction, protect shores and islands from surges and storms, and provide habitat for many reef-dwelling species that can potentially be used for pharmaceuticals. One study estimated the total net benefit per year of the world's coral reefs at US$29.8 billion. Tourism and recreation account for US$9.6 billion of this amount, coastal protection for US$9.0 billion, fisheries for US$5.7 billion, and biodiversity for US$5.5 billion.

Source: Russi et al. 2013; Cesar, Burke and Pet-Soede (2003)

Box 6 Ecosystem Services delivered by Amazon Forest

The Amazon provides a wide range of services for local communities as well as for the global population. Despite these crucial services, the Amazon undergoes massive deforestation. WWF published a report in 2009 to demonstrate the value of the ecosystem services supplied by the Amazon, and the need to recognise and account for these. The table below presents a number of significant ecosystem services provided by the Amazon forest and their related economic values, as far as they are known. As noted in the report, these different figures cannot be simply added together as they are based on different assumptions and the different services are not additional per se.

Table: Overview of ES and associated economic values provided by the Amazon

Ecosystem services	Economic value (US$ – year not specified)
Production of non-timber forest products	50-100 / ha / year
Production of timber, net present value of Reduced Impact Logging (not necessarily sustainable production)	419-615 / ha
Erosion prevention	238 / ha / year
Fire protection	6 / ha / year
Pollination of coffee plantations from forest (Ecuador)	49 / ha / year
Disease protection	Unknown
Carbon storage - damage avoided due to CO_2 emissions avoided	70-100 / ha / year
Carbon storage - value of total carbon stored in intact forest	750–10,000 / ha
Maintenance of biodiversity	Unknown
Cultural and spiritual aspects of the forest	Unknown
Existence value	10-26 / ha / year
Recreational and ecotourism use	3-7 / ha / year

Source: WWF (2009)

The following boxes give evidence from particular regional ecosystems – Amazon forests (Box 6), coral reefs and mangroves in Belize (Box 7) and wetlands in Africa (Box 8). Maintaining green infrastructure has been shown to maintain essential and valuable services in the Seoul metropolitan area in South Korea (Box 9).

Box 7 Ecosystem Services delivered by Coral Reefs and Mangroves in Belize

Burke *et al.* (2008) estimated the total value of ecosystem services related to reef and mangrove-related fisheries, tourism, and shoreline protection in Belize to be US$359-559 million per year, a significant proportion of national GDP (US$1.3 billion in 2007). Coral reefs and mangroves are highly interconnected habitats, physically supporting each other and providing habitat for fish species. Mangroves filter sediment and pollutants from coastal runoff, supporting the clean water favoured by corals. Many species rely upon both mangrove habitat and coral reefs for parts of their life-cycle.

Table: Value of ecosystem services delivered by coral reefs and mangroves in Belize (US$/km^2)

	Coral reef	Mangroves	Combined contribution
Tourism	0.1 – 0.12	0.15 – 0.18	-
Fisheries	0.01	0.01	-
Shoreline protection	0.08 – 0.13	0.28 – 0.39	-
Total per km^2/year	**0.19 – 0.26**	**0.44 – 1.02**	**-**
Total for all Belize/year	**268 – 370**	**174 – 249**	**395 - 559**

Note: Mangrove & reef fisheries and tourism values are not additional, as they include revenues that rely on both habitats. Values are expressed in million US$/km^2/year unless indicated differently (US$2007).

Box 8 Benefits of wetlands in Africa

Wetlands provide a wide range of ecosystem services including water quality amelioration, flood control, fisheries, tourism and coastal protection. The economic value of these ecosystem services has been estimated to range between US$125 and US$2,156 per hectare per year (Woodward and Wui 2001). Halting wetland degradation (Aichi Targets 5, 14 and 15) can have significant ecosystem service benefits for society as well as benefits for biodiversity conservation. Estimates of the economic value of wetlands across Africa reveal considerable benefits from a range of different systems:

- The Nakivubu urban wetland in Uganda provides up to US$1.3 million in water treatment and purification benefits annually to 100,000 local residents and nearby Kampala.
- The Hadejia-Nguru wetlands, a floodplain in Northeast Nigeria supports US$11 million in agricultural activities, US$3.5 million in fishing and US$1.6 million in fuel wood, annually.
- Lake Chilwa, Malawi's first Ramsarsite produces over 20% of the national fish catch. Its fisheries are valued at US$18 million per annum, alongside agriculture and other provisioning services.
- The Zambezi Basin wetlands provide over US$70 million in livestock grazing, almost US$80 million in fish production, and US$50 million in flood plain agriculture (Braat *et al.* 2008).

Box 9 Green infrastructure and ecosystem services in the Seoul metropolitan area in South Korea

A study estimated the value of ecosystem services provided by the forest and cropland in the Greenbelt – an area where development is restricted and nature protected - for over twenty four million inhabitants in the Seoul metropolitan area. The total annual economic value of ecosystem services of the Greenbelt was estimated at KRW 2,463 billion (US$2.3 billion; Ryu *et al*. 2013).

Ecosystem Services	Total(Million Won)	Forest(Million Won)	Cropland (Million Won)	
			Paddy	Upland
Provisioning Services				
Food	267,567		94,003	173,564
Water	243,988	199,126	43,091	1,771
Raw materials	22,353	22,353		
Regulating Services				
Climate regulation	811,714	691,180	51,078	69,456
Air quality regulation	148,262	141,900	2,884	3,478
Erosion prevention	207,190	192,345	14,845	
Hazard regulation	149,685	63,337	70,549	15,799
Waste treatment	16,443	12,335	4,108	
Biological control	12,591	12,591		
Cultural Services				
Aesthetic value	88,339	52,789	18,625	16,925
Recreation & tourism	494,806	472,052	11,921	10,833
Total (Million Won)	**2,462,938**	**1,860,008**	**311,104**	**291,826**

All countries and regions will benefit from achieving the Aichi Targets

There is clear evidence that all regions and countries will benefit substantially from achieving the Aichi Targets.

National studies generally report the economic benefits biodiversity conservation qualitatively. Nevertheless, a substantial number of reports quantitatively estimate the economic benefits of biodiversity, conservation and related ecosystem services. These include many studies at the site level, as well as some which have scaled up site-based estimates at the national or sub-regional level.

The summaries above and the tables appended to this report indicate a wide variety of per hectare values for the services that ecosystems provide. These variations reflect a range of different factors, such as:

- The condition and function of ecosystems and the quality of services they provide;
- The location of ecosystems relative to human populations, which affects the value of services such as water provision and purification, and protection against floods and storms;
- The usage of ecosystems – for example some coral reefs are more heavily visited by tourists than others;
- The methodologies employed, including for assessment of ecosystem services and for economic valuation;
- Economic variables – such as differences in incomes and the ability of residents and visitors to pay for ecosystem services.

For example, Croitoru (2007) found that the value of services delivered by Mediterranean forests ranged widely between southern (US$35/ha/yr) and northern (US$135/ha/year) countries in the region. Studies of the benefits of coral reefs in Australasia, Pacific, Asia and the Caribbean show that these vary widely between countries and locations, reflecting differences in geography, ecosystem function and economic structures, especially the importance of tourism. Even locally there are strong variations in value (Box 10).

Box 10 The Economic Value of the Coral Reefs of Saipan, Commonwealth of the Northern Mariana Islands (Aichi Target 10)

The ecosystems of coral reefs in Saipan provide valuable goods and services such as tourism and fisheries. The Total Economic Value (TEV) of the services supported by Saipan's marine environment was estimated at US$61 million per year. Market values make up 73% of the TEV, while the remaining 27% consist of non-market values. Due to uncertainties in the data and the analysis, the TEV may vary between US$42 million and US$76 million per year. With an annual value of US$42 million, the tourism industry is by far the greatest beneficiary of the services provided by coral reefs on Saipan. This economic importance is not reflected in the funds made available by the CNMI Government to manage the reefs. The study used Geographic Information System (GIS) tools to understand spatial variations in the value of these goods and services. The average value of reefs per square kilometre was estimated at US$0.8 million, and the highest value (at the most popular diving and snorkelling sites) at around US$9 million. The study found that the more valuable reefs tend to be in poorest condition and under greatest threat.

Source: van Beukering et al. (2006)

Evidence of the value of benefits is available for most of the Aichi Targets

Annex Table A3 summarises examples of the value of benefits of meeting individual Aichi Targets.

The best evidence relates to protected areas (both terrestrial and marine – Target 11), but numerous assessments have also covered the benefits of reducing losses of forests, wetlands and other habitats (Target 5), achieving sustainable fisheries (Target 6), reducing pollution (Target 8), conserving coral reefs (Target 10) and restoring degraded ecosystems (Targets 14 and 15).

Regional reviews yielded a few examples of the benefits of sustainable agriculture and aquaculture (Target 7), controlling invasive alien species (Target 9), species conservation (Target 12), genetic resources (Target 13) and implementing the Nagoya Protocol (Target 16). In general there is less quantitative evidence of the benefits of the enabling actions (Targets 1-4 and 17-20), although it is recognised that these are important in creating the conditions necessary to deliver conservation action under the other targets.

HLP (2012) focused especially on investment needs and resource requirements, but also gave a brief review of existing evidence of the range of benefits of meeting each of the Aichi targets. Some examples of the benefits of delivering individual targets at global level are given in the box below.

Box 11 Benefits of Meeting Individual Aichi Targets - Examples from HLP (2012)

Target 5 - Wetland conservation protects a wide range of ecosystem services including flood control, recreational and commercial fisheries, wildlife watching, hunting, amenities, habitat and storm protection. The economic value of these ecosystem services is estimated to range from US$125 to US$2,156 per hectare per year, supporting policy objectives related to coastal zone management, water quality, water infrastructure, climate and recreation. Protection of wetlands could involve annual savings in expenditures on dams of US$5.7 billion and in other public water infrastructure of US$11.4 billion globally.

Target 6 - Society is expected to gain from sustainably managing global fisheries through increases in resource rent, with an estimated total net present value of US$125 billion by 2020. The full benefits of rebuilding fish stocks would not be realized for several decades. The long-term (2013 – 2050) gain in resource rent is estimated to have a net present value of US $1,076 billion, yielding a long-term benefit-to-cost ratio of 4.3 (central estimates).

Target 7 - Benefits of sustainable aquaculture include the protection of mangrove forests, which provide at least US$1.6 billion per year in ecosystem services worldwide. Aquaculture that has minimum impact on mangroves, or even restores mangrove forest for biofiltration purposes, enhances ecosystem service delivery.

Target 8 - Addressing nutrient and marine pollution lowers the costs of treating water, increases recreational opportunities, improves fish habitat and health, increases property values, avoids costs associated with dredging and finding water supply substitutes, and increases aesthetic and existence values for biodiversity. A recent report estimated that eliminating marine debris would lead to an avoided cost of US$1.27 billion per year.

Target 9 - Meeting this Target would substantially reduce the total economic cost of damage caused by invasive alien species, which is estimated at 2-5% of world GDP, or approximately US$2.6 to 6.5 trillion per annum. There would be benefits to many sectors such as agriculture, forestry and fisheries as well as to biodiversity and the environment. IAS control offers substantial opportunities for job creation and poverty alleviation. Early action against IAS can significantly reduce overall control costs.

Source: HLP (2012)

Box 12 presents estimates of the value of benefits delivered by the Natura 2000 network of protected areas in the EU, relevant to Aichi Target 11.

4.2 Key Message 2:

Biodiversity is essential to sustainable development

Biodiversity is a powerful engine for delivering current and future sustainable development objectives at varying scales, including goals linked to food security, water security, livelihoods, climate change and disaster risk reduction, among other development goals.

Evidence from all regions of the world and presented throughout this report demonstrates that investments in biodiversity and in the implementation of the Aichi Targets will deliver significant co-benefits for sustainable development. The Targets are inextricably linked to all aspects of sustainable development including poverty alleviation, the rights of indigenous and local communities, long-term food security, human health, climate change mitigation, adaptation

Box 12 Benefits of Protected Areas – the EU Natura 2000 Network (Target 11)

It has been estimated that full implementation of the Natura 2000 network, which comprises about 18% of the EU land area, will deliver benefits worth US$280-430 billion, equivalent to between 1.7% and 2.5% of EU GDP (IEEP *et al.* 2011). This estimate includes the range of provisioning, regulating and cultural services delivered by the network. The stock value of the carbon stored by the network (i.e. mitigated emissions of CO_2) is estimated at between US$812 and 1,513 billion.

The Natura 2000 network is also very important for tourism and recreation, attracting between 1.2 and 2.2 billion visitor days per year across the EU27, with direct and indirect economic impacts reaching US$70-118 billion. The value of these recreational visits (based on users' willingness to pay) is estimated at between US$6.9–12.5 billion (BIO Intelligence Service, 2011).

The Lower Danube Green Corridor, spanning four countries (Bulgaria, Romania, Moldova and Ukraine) and 2.236 km^2, has made significant improvements to water quality, increased biodiversity, lowered risks from flooding and improved local livelihoods. These benefits are valued at US$697/ha/yr, and future earnings are estimated at US$119 million (EC 2011a).

A 2006 assessment by the Dutch Institute for Environmental Studies estimated the benefits provided by Natura 2000 in the Netherlands at around US$6,220 per ha per year. The largest benefits relate to recreation, tourism, regulating services and non-use values. From this the authors estimated the gross welfare benefits of all Natura 2000 areas in the Netherlands (1.1 million ha) at around US$6 billion (Kuik *et al.* 2006).

Site level estimates given by (Arcadis, 2011) are as follows:

- The Kalkense Meersen site, Belgium comprises around 1,000 hectares of grasslands, marshes, intertidal mudflats, river dunes and forests. The benefits associated with restoring the floodplain and extensifying grassland usage (improved water regulation and genetic/species diversity) are estimated at US$21.5 million per year.
- The Telascica site, Croatia, spans 7,050 hectares of coastal lagoons, Posidonia beds, large shallow inlets and bays, reefs, submerged sea caves, quiet beaches and a mixture of shallow coastline and rough cliffs). It provides significant tourism benefits (US$2.9–7.2 million per year), and functions also as a carbon sink (US$6.3–11.8 million per year) and Centre for Regional Cheese Production (US$63.3 million per year).
- The Muntanya de Montserrat site, Spain, comprises 7,270 hectares of cliffs and rock formations, with 25% forest cover, and attracts up to 3 million visitors annually. The estimated annual values are: carbon sequestration services - US$12.9 – 28.8 million; erosion control – US$31.6–41.6 million; and amenity and cultural values (connected to tourism and recreation) – US$48 million.

Box 13 Forests and sustainable development

The formal forest sector employs some13.2 million people across the world and at least another 41 million are employed in the informal sector.

Some 840 million people or 12% of the world's population collect woodfuel and charcoal for their own use

Wood energy accounts for 27% of total primary energy supply in Africa, 13% in Latin America and the Caribbean and 5% in Asia and Oceania and is increasingly used in developed countries with the aim of reducing dependence on fossil fuels. About 90 million people in Europe and North America now use wood energy as their main source of domestic heating.

Forest products make a significant contribution to the shelter of at least 1.3 billion people, or 18% of the world's population.

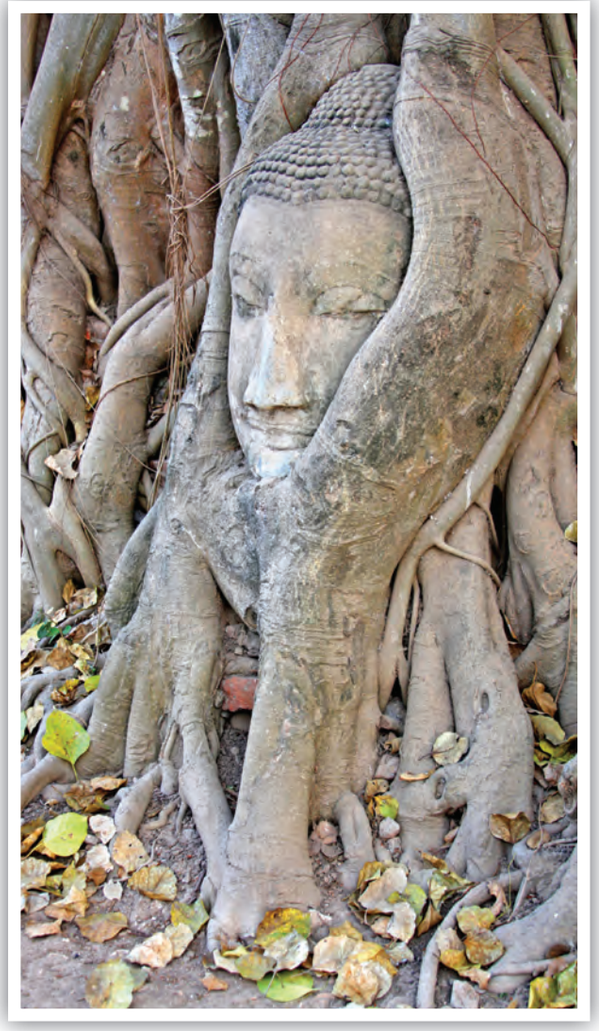
A major contribution of forests to food security and health is the provision of woodfuel to cook and sterilize water. It is estimated that about 2.4 billion people cook with woodfuel, or about 40% of the population of less developed countries. In addition, 764 million of these people may also boil their water with wood.

Source: FAO (2014)

and resilience; as well as to ecological infrastructure[68], local livelihoods, and job creation, thereby supporting national and global economies. Hence, biodiversity conservation and sustainable use constitute not only the environmental aspect of sustainable development, but are broadly linked to development as a whole (TEEB 2009:31 et seqq.), including economic and social dimensions. They will be an essential component of movement towards an inclusive green economy.

Box 13 highlights the importance of forests worldwide for fuel, shelter and employment, as well as timber, non-timber forest products and downstream ecosystem services. The widespread clearance and degradation of forests threatens the wellbeing of many millions of people, emphasising the economic and social importance of reducing forest loss (Aichi Target 5), and promoting sustainable use (Target 7) and restoration (Target 14).

There is clear overlap between the Aichi Targets and the current Millennium Development Goal 7 (MDG7) to ensure environmental sustainability. In addition, delivery of the Aichi Targets as a whole will make vital contributions to all the MDGs. Table 4.1 demonstrates the positive linkages between protected areas, poverty reduction and the current MDGs. Table 4.2 demonstrates the social and economic benefits resulting from four biodiversity conservation initiatives across the Latin America and the Caribbean region, and how achieving these benefits contributes both to the Aichi Targets and to the Millennium Development Goals.



[68] Also known as green infrastructure

Table 4.1 Positive linkages between protected areas, poverty reduction and MDGs.

Dimensions of poverty	Protected areas goods and services	MDGs
Economic opportunities Income generation, housing, food, alternative livelihoods, education and acquisition of new skills	Subsistence, livelihoods and nutrition	Goal 1: Eradicate extreme poverty and hunger (direct contribution) Goal 2: Achieve universal primary school (indirect contribution)
Empowerment Governance mechanism, community participation, benefits to women, children and young, access and rights	Human and ecosystems health, traditional healthcare Social and cultural governance Drinking and irrigation water, hydropower and erosion control	Goal 3 : Promote gender equality (direct contribution) Goal 4: Reduce child mortality (indirect contribution) Goal 5: Improve material health (indirect contribution) Goal 6: Combat major disease (direct and indirect contribution)
Security Health, social cohesion, cultural traditions, maintenance of natural resources	Reduce and mitigate natural disasters Reduce and adapt climate change	Goal 7: Environmental sustainability(direct contribution) Goal 8: Global partnership for development (direct and indirect contribution)

Source: Bovarnick et al. (2010)

Expenditure and actions to meet the Aichi Biodiversity Targets should be recognised as part of wider investment needs for achieving sustainable development in the context of the post-2015 sustainable development agenda

The period for meeting the Aichi Targets straddles that of the MDGs and the Post 2015 Sustainable Development Agenda (with SDGs to be attained by 2030). Despite the explicit inclusion of biodiversity in MDG7, the importance of biodiversity for the achievement of the other MDGs has not yet been sufficiently recognised or promoted.

In the post-2015 UN development agenda, biodiversity needs to be more integrated into broader development objectives. Biodiversity is central to goals relating to the conservation and sustainable use of terrestrial and ocean ecosystems and should be integrated, along with biodiversity-related targets and indicators, in to all other relevant Sustainable Development Goal (SDG) focal areas. At the same time, if sufficient policy coherence is achieved between the Aichi Targets and the Sustainable Development Goals, the SDGs can help to create the enabling conditions necessary for biodiversity conservation and sustainable use, including improved institutions, policy development, and increasing human capability to make informed decisions with respect to the natural world. Similarly, the Means of Implementation discussion (under the SDGs) and the biodiversity resource mobilisation agenda are mutually supportive, and adequate integration of biodiversity in the post-2015 framework at global and at national level will help reduce biodiversity financing needs.

The High-Level Panel found evidence from across the regions on benefits of investments in biodiversity conservation and sustainable use, relative to the SDG focal areas and this is presented throughout this report and summarised in Annex Table A4. Figure 4.1 illustrates key links relating to the potential contribution of the Aichi Targets to the SDGs. Even whilst this does not capture all the synergies and interlinkages between the Targets, it is clear that there are some significant opportunities for policy coherence and the delivery of cobenefits. The following sections present more detailed evidence relating to hunger and nutrition, water security and economic growth and employment.

Action for biodiversity is essential in efforts toendhunger and improve nutrition

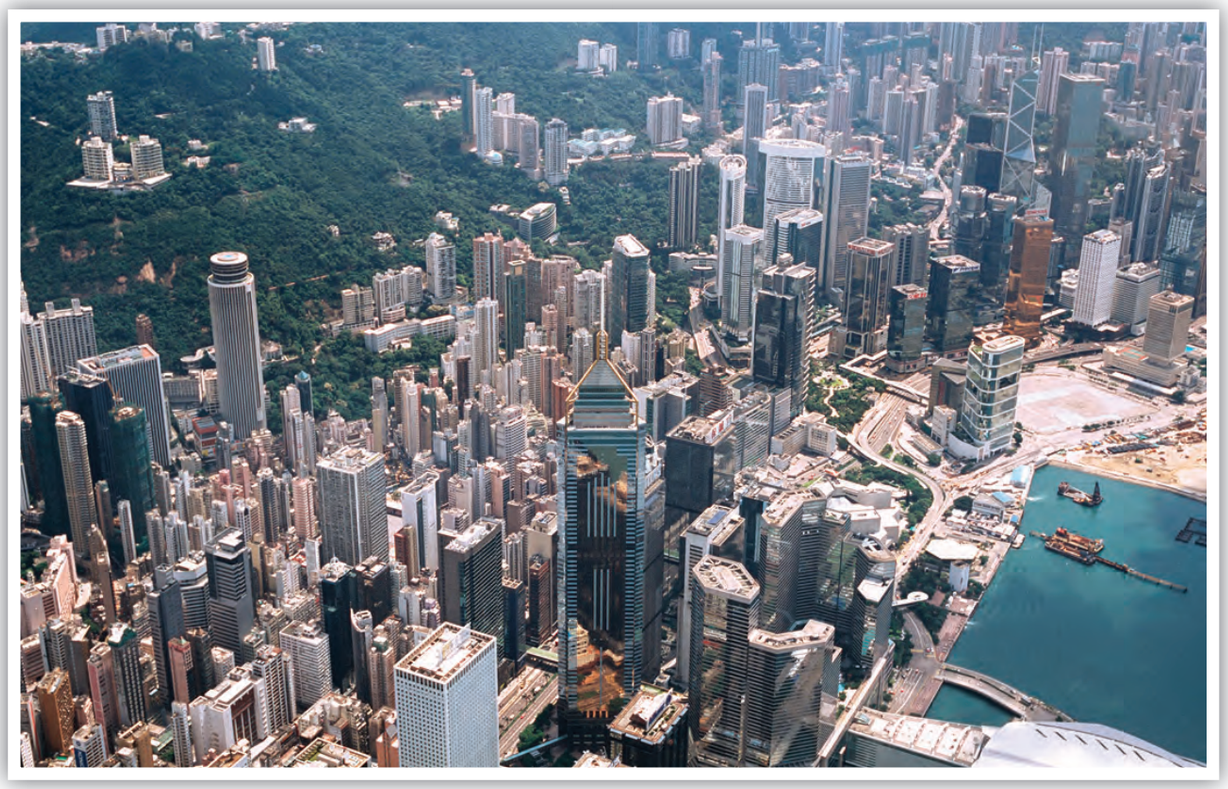
Investments in biodiversity will deliver essential ecosystem services for the long term sustainability

Table 4.2 Social and economic benefits from investments to deliver the Aichi Targets

Country	Project and Aichi targets (AT)	Social benefits	Economic benefits	Corresponding MDGs
Argentina	Establishment of incentives for the conservation of ecosystem services of global significance (GEF funded project) (AT 3, AT 5, AT 12, AT 7, AT 15, AT 11, AT 14)	14,000 families have improved access to potable water Profitability for poorest communities Gender equity in contracts assignment Capacity building	1,000 producers (farm products and tobacco) were able to irrigate some 19,000 hectares. Increase of local income	Goal 7: Environmental security Goal 1: Eradicate extreme poverty and hunger Goal 3 : Promote gender equality
Colombia	Water fund in Cauca valley, South western Colombia (TEEBcase by Goldman *et. al.* 2010) (AT 3, AT 11, AT 14, AT 5, AT 15)	Food security Environmental education Capacity building for sustainable production Stakeholders participation Social cohesion Indirect payments in the form of materials and training (supply fences and seeds, etc.)	Avoid costs of water dependent industry estimated at US$300 million per year. Avoid costs of water shortage for irrigation estimated to (9% of yields reduction, 10 tons/has).	Goal 7: Environmental security Goal 1: Eradicate extreme poverty and hunger Goal 3 : Promote gender equality
Ecuador	Quito Water Conservation Fund , FOWAG (TEEBcase by Arias *et. al.* 2010) (AT 3, AT 11, AT 14, AT 5, AT 15)	Environmental education program for children – 30,500 children. Food security Improve agriculture management Capacity building	Increase of employment in conservation activities Increase in income from rural conservation projects (hired, trained, and salaried 11 park guards). 200 families engaged in community development projects in rural basins.	Goal 7: Environmental security Goal 1: Eradicate extreme poverty and hunger Goal 2: Achieve universal primary school Goal 3 : Promote gender equality
Dominican Republic	Demonstrating Sustainable Land Management in the Upper Sabana Yegua Watershed System (GEF funded project) (AT 7, AT 11, AT 15, AT 14)	Increase awareness about land degradation Improved access to medical services and education Technical assistance and training to local farmers Increase capabilities in governance	Increase in local employment Increase in access to income	Goal 7: Environmental security Goal 1: Eradicate extreme poverty and hunger Goal 2: Achieve universal primary school Goal 5: Improve maternal health

Fig. 4.1 Relationship between the Aichi Targets and the SDGs

SDG		end poverty	food security	well being	education	gender equality	water	energy	employment	infrastructure	inequality	cities	sust production	cimate change	marine	land degradation	justice	sust development
Aichi Target		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
awareness	1				■								■			■		■
values	2	■										■	■			■		■
incentives	3		■												■	■		
nat res	4						■		■				■			■		
habitat loss	5						■						■	■		■		
fisheries	6		■						■						■			
sust land mgmt	7		■					■	■				■			■		
pollution	8			■			■					■	■		■	■		
IAS	9		■													■		
vuln ecos	10													■	■			
PAs	11						■					■		■	■	■		
species loss	12		■												■	■		
Gen div	13		■	■												■		
ES	14	■	■	■		■	■	■		■		■	■	■		■		
resilience	15	■					■	■		■		■	■	■	■	■		
ABS	16		■												■	■		
NBSAPs	17															■	■	■
Trad knowl	18	■		■		■										■		■
BD knowl	19				■					■	■				■	■		■
Resources	20										■					■		■



of agriculture and fisheries production (Box 14). For example:

- Soil biodiversity underpins soil fertility; and forested riparian corridors improve water quality for irrigation and reduced soil erosion (Prieur-Richard *et. al.* 2014)
- Pollination services make a significant contribution to the global food economy (Gallai *et al*. 2008)
- Genetic diversity provides the basis for the development of improved varieties and enhanced production and allows farming systems to adapt to ever changing conditions and the constraints caused by pests, diseases and other stresses (Smith, 2012)
- Healthy, functioning mangrove systems support coastal fisheries as vital feeding and nursery areas (Chong, 2007) and the presence of mangroves has been shown to enhance income from catches in offshore fisheries (Hicks *et. al.*, 2014).

Box 14 Essential ecosystem services for sustainable agriculture

It is estimated that the value of ecosystem services (e.g. organic waste disposal, soil formation, bioremediation, nitrogen fixation and biocontrol) provided each year in agricultural systems worldwide may exceed US$1,542 billion (Pimentel *et. al.,* 1997).

About 100,000 species of insects as well as birds and mammals pollinate more than two-thirds of food plants. Pollinators have been found to be worth more than US$200 bilion per year to the global food economy, which amounts to 9.5% of the total value of the world's agricultural food production (Gallai *et al*. 2008)

Genetic Diversity is central to the seed industry. Its top 10 companies had commercial seed sales of US$15 billion in 2006 (TST, 2013)

In addition, many of the world's poor are directly dependent on biodiversity as a primary food source, for acquiring a diversity of foods and nutrients, and for household coping strategies during times of stress (Hicks *et. al.* 2014). Bushmeat and other edible wild mammals, reptiles, birds and insects that live in trees and forests can account for up to 85% of the protein intake of people living in or near forests. One study found children in Madagascar were three times more likely to develop anaemia when bushmeat and its associated micronutrients were removed (Golden *et al*. 2011). Some 30 million people in coastal and island communities are totally reliant on reef-based resources as their primary means of food production, income and livelihood. The world's fisheries provide about 16% of the protein consumed worldwide (TST, 2013). Thus investments in biodiversity, and particularly in conservation, sustainable use and community management of those species that are primary food resources could make an important contribution to action to achieve food security and nutrition.

Biodiversity contributes to water security

By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under water stress conditions. Investments in the protection, sustainable management and restoration of biodiversity and ecosystems such as wetlands, forests, grasslands and soils offer significant solutions to water security including through regulating climate and rainfall, enhancing water storage, controlling land erosion and regulating water quality; and deliver multiple other benefits to society (CBD, 2013). The TEEB for Water and Wetlands report (Box 15) highlights the substantial value of the ecosystem services delivered by wetlands and the considerable value of benefits that can be expected from delivering wetland and coastal conservation actions.

Evidence from all regions of the world strongly endorses the value of 'natural infrastructure' for water quality and supply. In Chingaza National Park, Colombia, the Bogota Water and Aqueduct Company saved more than US$15million in treatment costs in 2004 by investing in watershed improvements. In Honduras, the cloud forests of La Tiga National park (23,871 ha) provide over 40% of the annual water supply to 850,000 people of Tegucigalpa. In 2008 it was estimated that about 80% of Quito's 1.5 million people reliedupon drinking water from two protected areas; Antisana and Cayambe-Coca Ecological Reserve and water companies were thus contributing to protected areas management costs (WWF, 2008). In Africa, the capacity of natural wetlands in the Western Cape, South Africa to remove excess nutrients was estimated to be worth US$1,913 per ha per year (Turpie, 2010).

Biodiversity provides jobs and economic opportunities

The world's fisheries employ around 200 million people (World Bank 2009) and have a value estimated at US$80 billion. Global fisheries "underperform" by US$50billion annually. Competition between highly subsidized industrial fishing fleets coupled with poor regulation and weak enforcement of existing rules has led to over-exploitation of the most commercially valuable fish stocks, reducing the income from global marine fisheries by US$50 billion annually, compared to a more sustainable fishing scenario (TEEB, 2010).

The aggregate costs for transitioning towards green agriculture were estimated to be US$198 billion per year (between 2011-2020) and represent a yearly increase in value added of about 9% and an addition 47million jobs in comparison with business as usual scenarios (UNEP, 2011, cited in CBD, 2014)

In Sub-Saharan Africa, the agriculture sector accounted for 12.7% of GDP in 2009, and employed more than 60% of the labour force. The formal forest sector employs some13.2 million people across the world and at least another 41 million are employed in the informal sector. Ecotourism generates significant employment and is now worth around US$100 billion/ year (TST, 2013). These economic sectors will benefit significantly from investments in biodiversity, the sustained delivery of ecosystem services and in improved sustainability of production systems.

Investments in the Aichi Targets will help to create jobs and support new economic and business opportunities. For example, establishing protected areas will create new opportunities for tourism-related business and employment; and other activities, such as control of invasive alien species and restoration will lead to job creation. In South Africa, the government-funded Working for Water (WfW) programme clears mountain catchments and riparian zones of invasive alien plants to restore natural fire regimes, the productive potential of land, biodiversity, and hydrological functioning. The programme was established in 1995 as a poverty-

Box 15 Ecosystem services values of the World's Wetlands

Inland wetlands cover at least 9.5 million km^2 (i.e. about 6.5% of the Earth's land surface), with inland and coastal wetlands together covering a minimum of 12.8 million km^2. These wetlands provide a range of valuable ecosystem services and the conservation of these systems and services are addressed directly in Aichi Targets 5 and 14.

Ecosystem type	Service type	Number of estimates	Min value (US$/ha/yr)	Max value (US$/ha/yr)
Mangroves & tidal marshes	Provisioning services	35	44	8,289
	Regulating services	26	1,914	135,361
	Habitat services[69]	38	27	68,795
	Cultural services	13	10	2,904
	Total	**112**	**1,995**	**215,349**
Inland wetlands other than rivers and lakes (floodplains, swamps/ marshes and peatlands)	Provisioning services	34	2	9,709
	Regulating services	30	321	23,018
	Habitat services	9	10	3,471
	Cultural services	13	648	8,399
	Total	**86**	**981**	**44,597**
Rivers and lakes	Provisioning services	5	1,169	5,776
	Regulating services	2	305	4,978
	Habitat services	0	0	0
	Cultural services	5	305	2,733
	Total	**12**	**1,779**	**13,487**

It is estimated, however, that 50% of the world's wetlands have been lost since 1900, and that these losses are ongoing, especially in Asia. A number of case studies in the report demonstrate the significant benefits of protecting and restoring wetlands around the world.

Protection and restoration of wetlands offers solutions to water security as well as many other benefits to society and the economy. Wetlands are an important component of green infrastructure, and are invaluable in supporting climate change mitigation and adaption, health and livelihoods, local development and poverty eradication. Maintaining and restoring them often offers cost savings when compared to manmade infrastructure.

Source: Russi et al. (2013)

[69] For example, the provision of suitable reproductive habitat, nursery grounds and sheltered living space

Box 16 Biodiversity Conservation and Employment in the EU

According to estimates, 2.5% to 16% (depending on definitions) of all jobs in the EU are dependent on the environment, whether directly or indirectly (TEEB 2009: 24). Further loss or degradation of biodiversity could therefore seriously impact the European labour market.

The Natura 2000 network is estimated to support a total of 4.5 to 8 million full-time equivalent (FTE) jobs through visitor expenditures alone (EP 2012).

An overall assessment of jobs and skills affected by the EU Biodiversity Strategy and its targets was conducted by ICF GHK and others (Jurado *et al.* 2012). The authors, although stating that the overall impact was difficult to assess due to overlaps between targets, estimated that the strategy could create 200,000 new full time equivalent jobs, and affect alarge number of other jobs.

Table 4.3: Impacts of EU Biodiversity targets on EU labour market

EU target	Aichi target(s)	Number of jobs created or sustained	Number of wider existing jobs affected
1 – full implementation of EU nature legislation	1, 11, 12	104,000 FTE jobs directly supported in Natura 2000 network. 174,000 FTE jobs including multiplier effects. 122,000 additional jobs	Existing jobs supported by Natura 2000 management estimated are 30% of total estimate.
2 – ecosystem restoration and protection, green infrastructure	8, 10, 14, 15	110,000 jobs supported in restoration of ecosystems/green infrastructure. Additional new jobs created in biodiversity offsetting.	Small proportion of the estimated restoration jobs are existing jobs. Implications for larger number of jobs in planning authorities through offsets and restoration activities.
3 – sustainable agriculture and forestry	5, 7, 13	11,250 additional FTE jobs through increased agri-environment activity. 3,000 additional FTE jobs in forest management planning.	A large proportion of existing 10.8 million FTE jobs in agriculture and 490,000 FTE forestry jobs will be affected, with implications for skills.
4 – sustainable fisheries	6, 7, 10	Up to 30,000 FTE fishing jobs lost by 2022; net loss of 10,000 – 17,000 FTE jobs compared to a no-reform scenario. Opportunity for growth in employment after 2020. Broadly neutral effect on employment in wider coastal communities.	130,000 existing FTE jobs in fishing will be affected by Strategy, with implications for skills.
5 – control of invasive alien species	9	Between 520 and 2,520 FTE jobs supported by IAS control programmes in total, including existing jobs. 250 – 2,250 new FTE jobs estimated.	Larger number of other existing jobs affected, including border and customs officers and pest control sectors, with implications for skills.
6 – averting global biodiversity loss	2, 3, 16, 17, 20	New jobs created in policy development and implementation.	Implications for skills requirements for larger numbers of existing jobs, including borders and customs officials, administrators in organisations dealing with genetic resources.

Source: Jurado et al. (2012)

relief initiative which aimed to provide employment and training opportunities for the unemployed. The WfW programme has an annual budget of more than half of the country's conservation agencies combined, and its success has spawned the development of several other initiatives, including Working for Wetlands, Working on Fire and Coast Care. 'Working for..' programmes have created jobs for 486,000 people since 1995 (Turpie *et al*. 2008, SANBI 2012).

Box 16 presents evidence of the implications for jobs and skills of meeting biodiversity targets in the EU. Box 17 presents examples of the contribution of wildlife tourism to employment and growth.

4.3 Key Message 3:

Biodiversity contributes to climate change mitigation, adaptation and resilience

Investing in biodiversity can effectively reduce national and community vulnerability, increase resilience and aid adaptation to climate-related impacts at all scales, and contribute significantly to climate change mitigation, including helping to meet mitigation targets.

Biodiversity contributes to climate change mitigation

Maintaining healthy oceans and restoring and conserving forests and wetlands are key strategies for climate change mitigation. Halving deforestation rates by 2030 would reduce global greenhouse gas emissions by 1.5 to 2.7 GT CO_2 per year, thereby avoiding damages from climate change estimated at more than US$3.7 trillion (net present value) globally (Eliasch 2008). It is well established that carbon stocks in intact forests are more resilient than those in degraded fragmented forests. Other mitigation actions include protection of soil carbon, and reducing emissions from wetland, marine and agricultural systems

Box 17 Benefits of Wildlife Tourism in Africa and Latin America

Tourism is one of the most rapidly-growing sectors in Africa, and accounts for about 5.8% of employment in sub-Saharan Africa (WTTC 2012). Much of this tourism is nature-based.

The wildlife-based tourism industry is now **Botswana's** second largest income earner after diamond mining, contributing 5% of the country's Gross Domestic Product (GDP) and 40% of employment in northern Botswana. Botswana's first Tourism Policy (1990) pursued a high value/low volume tourism strategy which has been very successful in the north. Tourism in the Okavango Delta has grown dramatically since the 1970s when it was almost non-existent. Visitors stay in luxurious photographic safari camps, hunting camps or fishing camps, all of which are temporary structures. Camp owners either pay a lease (a percentage of turnover) to the local government or to the communities, as well as royalties for hunting. Overall, the Okavango Delta area is estimated to generate a gross income of some US$112 million, making a direct contribution of US$40 million in terms of direct value added, about 2% of GDP. An estimated 81% of tourism value accrues to photographic tourism companies, 15.5% to hunting safari companies, and 3.5% to communities through Community Based Natural Resource Management arrangements (Turpie *et al*. 2006).

In the **Seychelles**, marine biodiversity is one of the main draw for a tourism industry that is now the mainstay of the economy and accounts for a third of all government revenues (Emerton 1997). Species-based tourism is of particularly high value, examples being gorilla and shark tourism. In **South Africa**, birding tourism is estimated to be worth US$79-152 million per year and is regarded as an area for investment. Much of the tourism potential of Africa's biodiversity remains untapped. Ecotourism is thus an important development opportunity that would be threatened by biodiversity loss.

Additional evidence from Latin America illustrates how protected areas support economic benefits from nature based tourism and recreation. In Mexico, 5.5 million tourists visited federal protected areas in 2006, spending an estimated US$286 million. In Peru, more than 350,000 people visited protected areas in 2005, generating US$146 million of economic activity (Bovarnick *et al*. 2010).

There is a growing body of evidence on the value of 'blue carbon' - carbon sequestration and storage in marine and coastal ecosystems. Mangroves are a significant global carbon store and sink, with the largest average carbon stocks per unit area of any terrestrial or marine ecosystem. The global average carbon stock of mangroves is around 1,000 tonnes of carbon per hectare, including soil carbon (Donato *et al*. 2011). It has been estimated that the carbon released as a result of conversion of coastal ecosystems (marshes, mangroves, sea grasses) amounts to 0.15-1.02 billion tonnes of carbon dioxide annually, equivalent to 3-19% of that released from deforestation, and with resultant economic damage of US$6-14 billion annually (Pendleton *et al*. 2012). The economic value of the role of high seas carbon sequestration has been estimated at between US$74 and US$222 billion annually (Rogers *et al*. 2014). Peatlands are also important stores of carbon, and their restoration can contribute significantly to mitigation efforts (Box 18).

Protected areas (Aichi Target 11) play an important role in climate change mitigation (Box 19).

Ecosystem-based mitigation and adaptation can be cost-effective and generate multiple benefits for society

The vulnerability of people, particularly the poor, to the impacts of climate change is inextricably linked to impacts on ecosystem services. Biodiversity and ecosystem services support climate change adaptation including through providing protection against extreme weather events and other disasters which will be worsened or intensified with the effects of climate change. Investments in biodiversity, and in the 'ecological infrastructure' that biodiversity underpins can provide direct adaption benefits including coastal protection (e.g. from the restoration of mangroves and coral reefs), flood regulation (from forests and wetland conservation) and protection for people and livestock from the sun. These

Box 18 Climate change mitigation benefits of peatland restoration and conservation

Peatlands cover only 3% of the global land area, but contain approximately 30% of all the carbon on land, equivalent to 75% of all atmospheric carbon and twice the carbon stock in the global forest biomass. They represent the most important carbon storage on land and the second most important one on Earth, next to the oceans. Drainage for agriculture or forestry turns peatlands from a carbon sink to a carbon source. CO_2 emissions from peatland drainage, fires and exploitation are approximately 3 billion tonnes per year, which equates to more than 10% of the global fossil fuel emissions. Restoration and conservation of peatlands is a key strategy for climate change mitigation.

Source: Russi et al. (2013) (TEEB for Water and Wetlands)

Box 19 Climate change mitigation benefits of protected areas

In Belarus, on-going restoration and protection of degraded peatlands is leading to an annual reduction of greenhouse gas emissions equivalent to 448,000 tonnes CO_2 from peatland fires and mineralization.

In Bolivia, Mexico and Venezuela, protected areas contain 25million hectares of forest, storing over 4 billion tonnes carbon, estimated to be worth between US$39-87 billion in avoided emissions.

4,432 million tonnes of carbon are sequestered in 39 Canadian national parks at a value of between US$72-78 billion annually.

Protected areas and indigenous lands in the Brazilian Amazon are likely to prevent an estimated 670,000km^2 of deforestation by 2050, representing 8 billion tonnes of avoided carbon emissions.

Source: Dudley et al. (2010)

Box 20 Biodiversity and ecosystem based adaptation

Effective conservation, restoration, and management of coastal systems, may be an effective ecosystem-based adaptation approach to climate induced changes in sea-level and storm frequency and intensity. Some examples are provided here.

Mangroves can rapidly reduce the energy of waves as they pass through the trees. The effectiveness of this barrier in reducing the height of relatively small waves has been found to be anywhere from13% to 66% over a 100m wide mangrove belt. Mangroves can reduce storm surge levels by up to 50cm per km width of mangroves. (UNEP 2014 *in press).*

In Belize, the value of the services provided by coral reefs and mangroves to coastal reef protection was estimated at US$120-180 million in avoided damages per year, with the protection from waves and storm surge from mangroves values at another US$111-167 in protection value (Cooper *et al*. 2008)

In Australia the coastal protection services provided by the Great Barrier Reef have been estimated at AU$10billion (US$9.3billion, NPV over 100 years with 2.65% discount rate) (Oxford Economics 2009).

In Switzerland, use of forests has been long recognised as a major component of disaster preventions and today forests in the Alpine region, making up 17% of Swiss forests are managed mainly for their protective function. Apart from the important human benefits, these protection forests provide services estimated at between US$2 and 3.5 billion per year (Dudley *et al*. 2010).

Box 21 Cost-effectiveness of combined carbon and biodiversity investments in Australian agro-ecosystems (Aichi Target 7, 12 & 15)

Putting a price on carbon can generate demand for carbon offsets which in-turn could drive investment in tree-based carbon sequestration in agricultural landscapes. A risk is that tree planting will focus on fast growing monoculture species that maximise the sequestration of carbon; this planting would have very little benefit for biodiversity. Using economic instruments such as species conservation banking or the trading of credits for creating biological diversity on private land, bundled with carbon credits fuelled by the demand to offset, could drive investment in planting of diverse species in locations that contribute to landscape conservation and restoration goals.

Crossman *et al*. (2011) demonstrate that in the presence of a carbon market, direct payments to private landowners of between AU$7/ha/year to AU$125/ha/year (US$6.5-116/ha/yr) may be sufficient to augment the economic returns from a carbon market and encourage tree plantings in agricultural landscapes that contribute more to the restoration of landscapes and endangered species' habitat than otherwise achieved by carbon monocultures. This study also shows that in the presence of a carbon market, the state of South Australia could achieve an ecological restoration target of 30% of agricultural landscapes covered by representative samples of biologically diverse vegetation with high connectivity and low fragmentation (1.1 million hectares of biodiversity plantings) for a total investment of AU$1.8 billion (US$1.7 billion). This may appear high, but the investment is inclusive of the opportunity cost of removing land from agricultural production.

Attaching biodiversity credits to carbon credits can lead to an efficient and cost-effective mechanism to restore degraded landscapes, sequester carbon and conserve threatened species.

Box 22 Joint planning of the Aichi Targets and REDD+

Miles *et al*. (2013) explored the scope for complementarities and synergies between the CBD and the UNFCCC, specifically the REDD+ mechanism. As recognized in CBD Decision XI/195, it may be helpful for countries to consider how activities under REDD+ and those aimed at achieving the Aichi Targets may complement one another, and to promote synergies between them. Synergies were discussed with particular attention to Aichi Targets 5, 7, 11,14 and 15 and it was found that action for REDD+ can help achieve the Aichi Targets and vice versa, but that how these actions are planned and implemented is key to determining to what extent synergies are achieved. For example, if the Cancun safeguards are respected and addressed, then this will increase the ability of REDD+ to contribute towards the targets. Without coordination on policy, REDD+ decisions could place constraints on the range of options feasible for Aichi Biodiversity Target implementation, or vice versa. Joint planning for REDD+ implementation and the achievement of the CBD Aichi Targets (including through enhanced collaboration and coordination across CBD and REDD+ focal points and implementing agencies) would help countries to enhance likely synergies and minimise conflicts. Complementary efforts on information collection, management and sharing could improve datasets on forests, biodiversity and on other national priorities that will influence land-use decisions. For example, some countries have undertaken a gap analysis of how well biodiversity priorities are covered by the existing protected areas system. The results could be of use in land-use planning for REDD+ that also delivers biodiversity conservation benefits. Developing policies that advance both sets of goals may be cost effective in terms of financial expenditure and land allocation.

Box 23 Joint climate change and biodiversity planning in the Philippines

The Philippines provides an example of a country preparing to streamline investment through local development plans for both biodiversity and climate change objectives. The Strengthening Coordination for Effective Environmental Management Project (STREEM) strengthened coordination among the CBD, UNFCCC and UNCCD focal point agencies by highlighting the relationship between biodiversity loss, land degradation and climate change in community Investment Plans. Mangrove rehabilitation and reforestation strategies were included in these plans that were incorporated into Barangay Development Plans after mobilising funding from the Protected Area Management Board.

investments will enhance resilience, including through safeguarding water, food security, and securing livelihoods options. This will be increasingly important in helping communities adapt to climate change and in minimising damage and loss.

The role of local communities in assisting with ecosystem-based adaptation should be recognised and investments targeted towards enhancing their contributions (including with indigenous and local knowledge), addressing vulnerabilities and building resilience to climate change.

There is a need to further understand impacts of climate change on biodiversity, and their implications for ecosystem-based mitigation and adaptation as well as to enhance the climate resilience of such interventions. At the same time, there is a need to improve understanding and consider trade-offs and co-benefits for biodiversity when developing wider climate change mitigation and adaptation policies and approaches.

The potential for enhancing synergies between the Aichi Targets and policies to address climate change is not yet fully utilised and there is significant scope for improvements in this regard

As demonstrated above, there are significant alignments and inter-dependencies between the Aichi Targets (particularly Targets 5,7,11,14 and 15) and policies to address climate change. Investments in REDD+ for carbon mitigation are highly important for biodiversity conservation as well as for securing

livelihoods provided that adequate safeguards are in place and potential trade-offs are addressed.[70] Nature-based solutions for climate adaptation can be cost-effective and contribute to the objectives of both the UNFCCC and the CBD. The Aichi Targets (support policies to promote ecosystem based adaptation, such as coastal protection (e.g. restoration of mangroves and coral reefs) and watershed protection (e.g. forest and upland conservation).

The case studies below show how synergies between carbon and biodiversity financing could be used to meet conservation targets at lower cost. Joint planning and investments forclimate policies and biodiversity conservation have not yet developed to the same extent as for other policy domains (e.g. climate change adaption and disaster risk management) and there is significant scope for improvements in this regard.

4.4 Key Message 4:

Investments in biodiversity can strengthen the provision of ecosystem services on which vulnerable communities depend

As biodiversity loss disproportionately affects vulnerable populations, investments in biodiversity will secure the long-term provisioning of key services and access to critical biodiversity resources that are essential for food security, economic opportunities, human well-being and quality of life.

Regional evidence demonstrates that many vulnerable people and communities within developing countries are particularly dependent on ecosystems and their services. About 70% of the world's poor - some 870 million people - live in rural areas and many are directly dependent on biodiversity for their survival and wellbeing, including for the direct provision of food, fuel, building materials, clean water, medicinal plants and other necessary goods. It is well established that many millions of people living in rural areas of developing countries are dependent on medicinal plants for their main or primary source of healthcare (Hicks *et. al.* 2014). The urban poor also rely on biodiversity, including for ecosystem services such as the maintenance of air and water quality and the break-down of waste (CBD 2010). Achieving the Aichi Targets, therefore, can be expected to provide great benefits to lower income communities. Conversely, a failure to meet the Aichi targets and to achieve sustainable use of natural resources is likely to impact most on the livelihoods and wellbeing of the poor. In South Africa, it was calculated that the value of livelihood benefits derived from the degraded Manalana wetland (located near Bushbuckridge, Mpumalanga) was just 34% of what could be obtained from a healthy ecosystem (Pollard *et al*. 2008, cited in Chenery *et al*. 2013).

For many of the world's poor and vulnerable communities, lands and natural resources and associated traditional knowledge, are their primary capital assets, providing options to those that may otherwise have none

Land based sectors account for a large proportion of economies and employment in rural parts of

[70] See Appendix 1 to the UNFCCC Decision 1/CP.16 Appendix 1 to the UNFCCC Decision 1/CP.16, "Guidance and safeguards for policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries" available at UNFCCC/CP/2010/7/Add.1, 15 March 2011, pages 26-27, http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf, accessed 17 August 2012. The CBD Secretariat has provided advice on the application of relevant safeguards for biodiversity with regard to REDD+ UNEP/CBD/COP/11/24, Note by the Executive Secretary, 24 August 2012, http://www.cbd.int/cop11/doc/ accessed 1 October 2012.

developing countries and the value of ecosystem services can represent a high proportion of overall incomes. Box 24 shows the importance of biodiversity for socio-economic development and poverty reduction in Lao PDR. Boxes 25 and 26 illustrate the value of provisioning services in Asia and in Africa. Biodiversity can provide diverse livelihood options, including a vehicle for starting small businesses and can be a lifeline for poor households during times of crisis. Biodiversity provides wild protein to supplement agriculture and nature based livelihoods to diversify on-farm income and offset the boom and bust of small-holder farming. The sustainable use of natural resources is essential for the sustained and equitable sharing of the benefits nature provides in creating such socio-economic opportunities.

Box 24 Links between biodiversity and poverty reduction: the case of Lao PDR.

In Lao PDR, biodiversity is important for socio-economic development and poverty reduction and its population is highly dependent on biodiversity, including its poorest and most vulnerable communities. It was estimated that more than 80% of the country's 5.5 million people live in rural areas. Besides rice farming, they also depend on harvesting wild plant and animal products for their day-to-day subsistence income.

The Nam Et-Phou Loei (NEPL) Protected Area is located mostly in the Viengthong District, where the economic value of forest product utilisation for villages is estimated to be worth more than US$1.12 million per year or US$313 per household. The study found that home consumption made up the bulk of the economic value with an average of US$229/household/year compared to cash income of US$84/household/year. The study also reported that the value of forest use was highest for the households who live closest to the NEPL at an average of US$500 for villages located inside the PA, US$270 for households bordering the PA and US$160 for households outside the PA.

At the national level, biodiversity was estimated to be worth around US$650 million per year. This includes contributions from forests, wildlife, aquatic resources and agro-biodiversity. The analysis of the full value of biodiversity shows that biodiversity contributes directly or indirectly to three quarters of the country's per capita GDP, more than 90% of employment and almost 60% of exports and foreign exchange earnings.

Source: Emerton (2005)

Box 25 Provisioning Services of Ecosystems in Asia

In many Asian countries, a majority of the population depends on crop production, livestock rearing and fisheries for its livelihood. The natural capital associated with each of these livelihood options has large economic benefits and significantly influences the incomes generated from such livelihoods. All countries have rich crop genetic diversity, which has an insurance value for vulnerable populations.

In addition, collection of non-wood forest products (NWFP) is an important activity for forest dependent communities in many Asian countries. In Southern Asia, the economic benefits of NWFP are estimated to range from US$1000 to more than US$6000 per hectare per year. In the context of forest dependent communities, these benefits generally constitute 50-80% of average annual household income and are thus very significant.

Source: regional report for Asia in CBD (2014)

Box 26 Provisioning services in Africa

In Mtanza-Msona Village in Tanzania, more than a third of households live below the poverty line, and the surrounding wetlands and woodland resources are critical to their well-being, supplying fuel, raw materials, wild foods, and providing opportunities for generating cash income. These harvested resources are worth some US$107 per capita, or 37% of income (Kasthala *et al*. 2008).

Similarly, in the Democratic Republic of the Congo (DRC), wild foods account for about a third of household production and generate twice as much cash income as crop sales (de Merode *et al*. 2003).

In rural areas of Oyo state in Nigeria, one study showed that indigenous fruits and vegetables contribute at least 25% to household income (Oladele 2011).

In Cameroon, the Central African Republic, the Republic of the Congo and the Democratic Republic of the Congo, edible insects—especially caterpillars—are a main source of protein for communities living around forests. Their trade also provides income for rural people, especially women (Vantomme *et al*. 2004).

The miombo woodlands of southern and eastern Africa provide fuelwood and other resources for approximately 100 million people (Boucher *et al*. 2011).

In South Africa, the annual value of wild edible herbs consumed in one area was US$167 per household, and exceeded the opportunity cost of farm labour (Dovie *et al*. 2007).

Biodiversity action needs to take account of distributional impacts, to ensure that benefits for poor and vulnerable communities are secured

A wide variety of people and businesses benefit from biodiversity, and from investments in biodiversity conservation and sustainable use, through a range of marketed and un-marketed benefits. Box 27 considers the range of beneficiaries of biodiversity action in Europe.

While the evidence highlights the benefits of halting biodiversity loss, widespread degradation of ecosystems continues to occur. This is often because there are short term incentives for businesses and individuals to degrade or convert an ecosystem for short term private gain, at the cost of longer term losses for society as a whole, including for the poor and vulnerable who are directly dependent on ecosystem services. Those responsible for managing ecosystems or making decisions about their future may capture only a small proportion of services that they deliver, and may lose out, particularly in the short term, from actions for the conservation and sustainable use of biodiversity that deliver net benefits overall. There are numerous examples of these distributional effects in the regional evidence (Box 28) and this is one of the key barriers to achieving effective biodiversity conservation and sustainable use.

In cases where the opportunity costs of conservation and sustainable use impact most on the poor and vulnerable, effective action will depend on effective means to address these distributional effects and the creation of improved incentive structures and risk management strategies (including through Aichi Target 3). These must take into account the needs of local and indigenous communities, assess distributional effects and ensure that potential negative impacts are identified and addressed. Such means may include national regulation (e.g. preventing powerful actors transforming land that is of benefit to local communities), programme design (e.g. favouring job creation and drawing on local communities for jobs) and project implementation (e.g. skills and development are included in implementation).

Amongst the means mentioned above are the people and local communities and other land managers to capture a larger proportion of the value of ecosystem services through payments for ecosystem services (PES) schemes. Box 29 gives an example of PES in Colombia, and Key Message 8 discusses in more detail the development of PES in

Box 27 Beneficiaries of biodiversity conservation in Europe and the Former Soviet Union

The review of European evidence drew the following conclusions about the distribution of benefits of meeting the Aichi Targets:

- The loss of biodiversity and related ES will affect the poorer Eastern European countries (which are more directly dependent on land based sectors) more than the more developed EU and Western European countries. For example, 47% of Georgia's population lives in rural areas and 80% of rural households use fuel wood extracted from nearby forests for heating and cooking (TEEB 2013). Similar patterns are observed in other countries such as Moldova, parts of Belarus and Ukraine, as well as EU countries such as Romania and Bulgaria.

- Ecosystem services benefit society as a whole. However, in many cases, the distribution is uneven, and can both tend towards benefitting poorer or discriminated groups of society, and privileged individuals or private entities (such as companies). For example, green spaces close to urban areas may have disproportionate benefits for poorer communities with less access to green space, who are also more susceptible to health conditions such as obesity, mental health, circulatory disease and asthma (EC 2011). Green spaces or protected areas close to cities will benefit the urban population much more than the rural, as the latter generally has more access to green areas.

- Sectors more dependent on ES provision will benefit most from biodiversity conservation. These include fisheries, forestry/wood products, agriculture (dependent on services such as pollination, biological control, soil formation and genetic diversity), water supply, pharmaceuticals and cosmetics, chemicals, food and tourism (EC, 2011). These will be affected more severely by biodiversity loss than other industrial sectors.

Box 28 Beneficiaries of conservation action

In the case of the Leuser forest ecosystem, Sumatra, deforestation provides direct income to private enterprises involved in logging; however forest conservation (Aichi Targets 5, 11) benefits a wider range of people and sectors through enhanced water services, reduced flooding and fire risk, and benefits to agriculture, fisheries and tourism. The global community benefits through climate regulation and biodiversity conservation. The evidence shows that the benefits of conservation exceed those of deforestation if the range of beneficiaries are considered (van Beukering *et al.* 2003, 2009)

In Cambodia – logging may deliver local benefits, which are offset by the global climate benefits of forest conservation. Some financing mechanisms were found to be essential to ensure ongoing conservation (Grieg-Gran 2008)

In the Mbaracayu Forest Biosphere Reserve, Paraguay – estimates found that the benefits of conservation greatly exceed costs, due to the high value of carbon storage, but that the local opportunity costs of conservation may exceed the benefits (Naidoo *et al.* 2006)

In Vanuatu, mangroves benefit a wide range of local people including local fishermen, families that harvest fish, firewood and construction material, tourism enterprises, property owners benefiting from flood protection, as well as the global community that benefit from carbon sequestration. Recognising the range of benefits and beneficiaries is important in informing conservation strategies(Pascal 2013).

Box 29 PES in Colombia

Valle del Cauca (Cauca Valley) in Southwestern Colombia is a highly productive and fertile region, with a huge number of sugarcane producers, an important export and domestic crop for the country. This region lies in a very rich hydrological system containing important watersheds supplying water to 900,000 people residing in the cities, including the city capital Cali. This region is quite sensitive to climate factors causing water scarcity during the summer. A water fund was implemented to secure biodiversity and water-related services benefits, particularly reduction in sedimentation and maintenance of water flows. Activities carried out through investments by the fund include conserving at least 125,000 hectares of the natural ecosystems and improving management of the landscape. These activities will benefit 920,000 people downstream and sugar cane production, an important industry for the Colombian economy (TEEBcase 2010).

Box 30 Safeguarding vulnerable communities against unintended impacts of biodiversity finance mechanisms

Appropriate safeguards can be helpful to address unintended impacts of financing mechanisms and for improving fairness and equity between different stakeholders, including in relationships between governments and the private sector and with local and indigenous communities. The specific substantive (e.g. land and resource tenure rights) and procedural safeguards (e.g. participation, transparency) need to respond to the risks and opportunities of each biodiversity financing mechanism which a particular country decides to use. Yet, safeguarding efforts can be more effective by harmonising different safeguards in scaling-up biodiversity financing The design of national safeguards, that support implementation of the Aichi Targets, may be fostered around dynamic processes grounded in specific local realities that are linked to national and international processes and that observe internationally agreed commitments regarding the support to sustainable livelihoods and the conservation of biological diversity, in for example, the CBD, UNFCCC, international human rights treaties and the United Nations Declaration of the Rights of Indigenous Peoples.

Source: Ituarte-Lima et al. (2014)

Costa Rica. Similarly in North America, examples of PES schemes such as that established in the Catskill Mountains, USA (Box 71) demonstrate that ecosystem conservation and restoration can be effective and deliver net benefits, where payment mechanisms can be developed so that land managers are compensated by the beneficiaries. In this case beneficiaries are the citizens of New York, whose water bills went up about 9% rather than doubling, as would have been expected had a new water treatment plant been built. These schemes also show how funds can be leveraged from other sectors once the case for biodiversity supplying relevant services has been made. In other regions, such as Africa, progress on PES schemes has been reported as slower, but REDD projects that involve international buyers appear to be progressing better than those (e.g. for hydrological services) where buyers are local. Where a large share of benefits from conservation action accrue to the global community, then global payment mechanisms such as REDD+ will continue to be important in incentivising local conservation action.

A report by OECD ("Scaling up Finance Mechanisms for Biodiversity, OECD 2013) reviewed six finance mechanisms and identified key design mechanisms, including the assessment of distributional effects and the design of social safeguards (Box 30) to ensure benefits to the lowest income communities and address any potential adverse effects. In addition, it found that secure and well defined property and land tenure rights were a prerequisite for success. Finance mechanisms are discussed in more detail under Key Message 8.

It has also been shown that taking into account and addressing the distribution of monetary and non-

Box 31 Effectiveness of direct payments for biodiversity conservation, Cambodia

A direct payment program was established for nine globally threatened bird species in the Northern Plains of Cambodia. The program was initiated in 2003 by the Wildlife Conservation Society in collaboration with the Cambodian Ministry of Environment and Forestry Administration and provided conditional payments to local people to protect nests, since most of the species were highly threatened by the collection of eggs and chicks. The effectiveness of the program was evaluated for the period 2009-2011 through a system of monitoring protected sites and unprotected control sites. Protected sites were shown to have substantially higher nesting success rates than control sites, leading to population increases for at least three species. The program was deemed to be a highly effective conservation intervention to protect highly threatened globally significant biodiversity, in a way delivered significant benefits to local people. However, payments did not influence other threats to species, such as land clearance, and have failed to arrest declines in at least one species' population. The average payment per protector was a significant contribution to incomes in remote rural villages. However, the program only benefited a small proportion of people, causing some local jealousies and deliberate disturbance of nesting birds. The program demonstrates that direct payments can be a highly effective conservation tool in those cases where payments correctly target the cause of biodiversity loss. However, the results also suggest that it is important to consider how decisions over beneficiaries are made, especially in situations where property rights over biodiversity are unclear, if payments are to be socially acceptable. This has important implications for the design of payment schemes in conservation more generally.

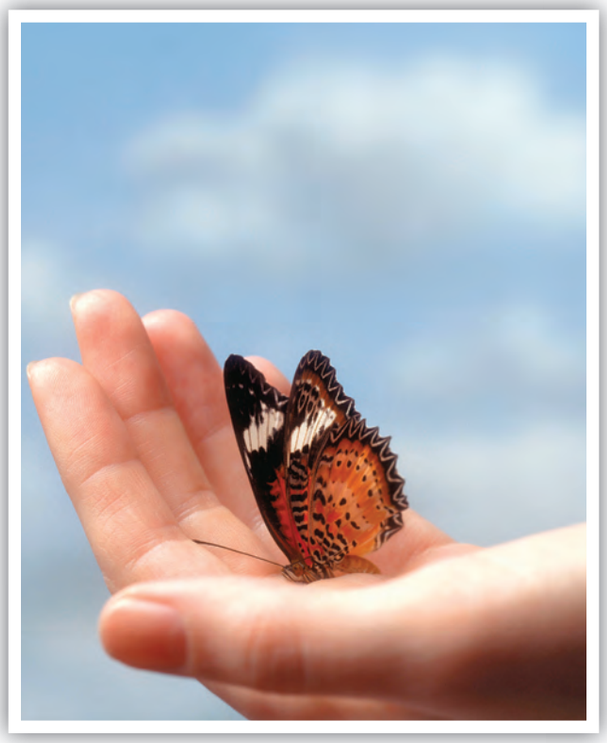
Source: Clements et al. (2013)

monetary benefits *to and within* local communities, including for women, is likely to increase the cost effectiveness of activities towards conservation and sustainable use of biodiversity. A case study on the effectiveness of direct payments for biodiversity conservation in Cambodia (Box 31) shows the importance of considering the distribution of benefits for payments to be socially acceptable. A review of forest management and gender highlighted that women have different benefits from, access to and control over forests. Women's needs and concerns in relation to forest management are often neglected, and they have little power in determining development activities. Forest management projects that consider these needs and concerns have a greater chance of achieving a successful environmental and social impact (WWF 2012).

4.5 Key Message 5:

Biodiversity provides insurance and option values

Investments in biodiversity can provide insurance against future change and uncertainty and maintain and enhance future development options. Investments made now will reduce future costs and preserve opportunities for current and future generations



Biodiversity and ecosystems play an important role in providing insurance against present and possible future risks

Conservation and sustainable use of biodiversity are important not just for the range of values of the services that they currently provide, but also because of their insurance and potential option value, for mitigating risks and for development opportunities.

'Insurance' is closely related to *resilience*, defined as the capacity of a social-ecological system to withstand perturbations from, for example, climate or economic shocks and to rebuild and renew itself afterwards, without shifting into a qualitatively different state (Folke, 2011). Resilience has increasingly been acknowledged as an important factor in determining ecosystems' capacity to continue generating ecosystem services in a world increasingly influenced by global environmental change. There is a strong correlation between biodiversity and an ecosystem's resilience, and its ability to deliver ecosystem services. Thus, investments targeted at safeguarding critical ecological resources and functions will increase the ability to 'ride through' shocks - such as extreme events. Safeguarding species and populations will protect the genetic variety of life, as well as the potential current and future values that may be associated with them. This is of critical importance considering future uncertainty and limited understanding of the vulnerability generated by anthropogenic change.

Healthy, functional and resilient ecosystems are increasingly being seen as a 'life insurance' policy for many communities, providing benefits across sectors including disaster risk reduction; food security; sustainable water management and livelihood diversification (Munang *et al*. 2013). For instance, farmers might safeguard food security and incomes by spreading their risks when planting many different crops and varieties along with home gardens. This diversity serves as a base and insurance for livelihoods (Rockström and Schultz, 2011). Biodiversity provides a safety-net during times of food insecurity, particularly during times of low agricultural production, during other seasonal or cyclical food gaps or during periods of climate-induced vulnerability (Sunderland 2011). The insurance concept is important in agricultural production and is an important concern for both large and small scale producers.

There is an ongoing need to understand the importance of biodiversity for decreased vulnerability in local to global systems.

Failing to invest in biodiversity now will increase the risks and costs in the future

The World Economic Forum Global Risks report (WEF, 2014) found that four of the eight largest global risks are ecosystem-based. Taking insufficient action to address biodiversity loss will risk losing current and future benefits that could become vital in the future.

Ecosystems may generate output values (the aggregated value of the ecosystem service benefits provided in a given state, such as food production, climate regulation and recreational values) as well as insurance values. Even if an ecosystem, or ecosystem component, currently generates no or a low output value, its insurance value may still be significant (TEEB 2010a). For example, drinking water might be cheap in cities with sufficient clean water. But an impact, due for example to bad management practices of forest areas upstream, might create loss of water and generate a completely different value. Similarly, even if assessments of a particular forest patch reveal only small values today (output value), because the crops presently grown might not be directly dependent on pollinators, future changes, for example in demand for food, may cause farmers to change to crops which are more directly dependent on pollination. If pollinators have since become diminished then this might create problems. Coastal areas not presently important for fish nursery may become very important if most areas for fish nursery in the surrounding are degraded.

The case study in Box 32 compares the human and material losses due to catastrophic landslides and floods of 2011 in a neighbourhood in the mountain area of Rio de Janeiro, Brazil, with the costs of implementing good practice for the management of Areas of Permanent Preservation (in riparian zones, slopes and elevated areas). The study concluded, in the light of projected increases in rainfall and extreme rainfall events in future years, that implementing good practice in riparian APPs management would lead to a significant net benefit in areas such as those affected by the 2011 tragedy.

In cases such as this, policy and practice can be informed by the inclusion of insurance value in scientific assessments, using scenario analysis and risk assessments and applying the precautionary principle. Use of appropriate discount rates in economic analysis will help to assess the value of future benefits, and address intergenerational equity.

Box 32 Economic valuation of permanent preservation areas in the mountain region of Rio de Janeiro state, Brazil

In January 2011, torrential rains fell on the mountain region of Rio de Janeiro state, Brazil, resulting in catastrophic human and environmental losses. As a contribution to prevent similar tragedies in the future, the project Protection for the Atlantic Forest II (coordinated by the Brazilian Ministry of the Environment and supported by the Brazil-Germany Technical and Financial Cooperation in the context of the International Climate Protection Initiative (IKI)), made efforts to produce and disseminate information relevant to decisions involving risk management in the Brazilian Atlantic Forest.

Among these efforts, was a study which sought to compare the costs of the losses incurred in the areas hit by floods and landslides during the 2011 tragedy with the costs of implementing legally required good practices for the management of Areas of Permanent Preservation (APPs - which include strips along riparian zones, as well as slopes and elevated areas), such as relocation of human settlements and reforestation with native plant species. In APPs located in riparian zones, extreme events would cause direct economic damages only if they were occupied by human settlements or used for activities such as agriculture. In this case, the method of avoided damages may be used to argue that the human and material losses incurred in an extreme climate event represent an approximation of the economic value of the ecosystem service "protection against extreme climate events" provided by APPs in riparian zones.

The study focused on two neighborhoods in the municipality of Teresópolis: Campo Grande and Bonsucesso. The estimated human and material losses of the 2011 tragedy were estimated at US$55-185 million for Campo Grande and US$8-26 million for Bonsucesso, mostly in human wellbeing losses caused by mortality and morbidity. The costs of implementing legally required good management practices in the studied neighborhood's riparian APPs were estimated at US$3-9 million for Campo Grande and US$3-8 million for Bonsucesso.

Costs of the tragedy and costs of good management of APPs (US$000, 2011)

APPs of riparian areas	Campo Grande		Bonsucesso	
	Lowest	highest	Lowest	Highest
Costs of tragedy	55,273	184,922	8,123	26,162
Costs of good management of APPs	3,347	9,219	3,121	8,415

Considering that observations and projections of rainfall and frequency of extreme rainfall events in Rio de Janeiro state suggest that both will increase during the 21st century (Dereczynski*et al*, 2013), the results of this analysis indicate that implementing good practices of riparian APPs management would lead to significant net benefits in areas such as those affected by the 2011 tragedy. This benefit level varies with the individual circumstances of each area, including their level of human occupation.

Source: MMA (2013)

4.6 Key Message 6:

Enhancing synergies, addressing trade-offs and promoting alignments across sectoral policies are prerequisites for effective implementation of the Aichi Targets and of major importance for resource mobilization

Developing harmonised objectives across sectors to develop and implement mutually supportive policies and activities, and increased efforts to manage trade-offs are all important steps for achieving the Aichi Targets, delivering co-benefits and developing cost-effective pathways towards a sustainable society. This will help to identify co-funding opportunities and to secure contributions to meeting the Aichi Targets from a wide range of sources across economies and societies.

At all levels, increased alignment is needed between the Aichi Targets and other policy agendas, including

development, growth, poverty alleviation, climate change, agriculture, forestry, fisheries, water and health.

Enhancing synergies across the biodiversity-related conventions and other Multilateral Environmental Agreements could increase the effectiveness of spending and lead to resource savings

Numerous other biodiversity conventions and MEAs have the potential to contribute to the delivery of the Aichi Targets including the Convention on International Trade in Endangered Species (CITES), Convention on Wetlands of International Importance (Ramsar Convention), the Convention on Migratory Species (CMS) and the World Heritage Convention (WHC). Other MEAs also have linkages to the conservation and sustainable use of biodiversity including the. United Nations Framework Convention on Climate Change (UNFCCC); United Nations Convention to Combat Desertification (UNCCD); United Nations Convention on Law of the Sea (UNCLOS); and the Stockholm Convention. Figure 4.1 illustrates the contribution of the UN system and the UN Conventions to the Aichi Targets.

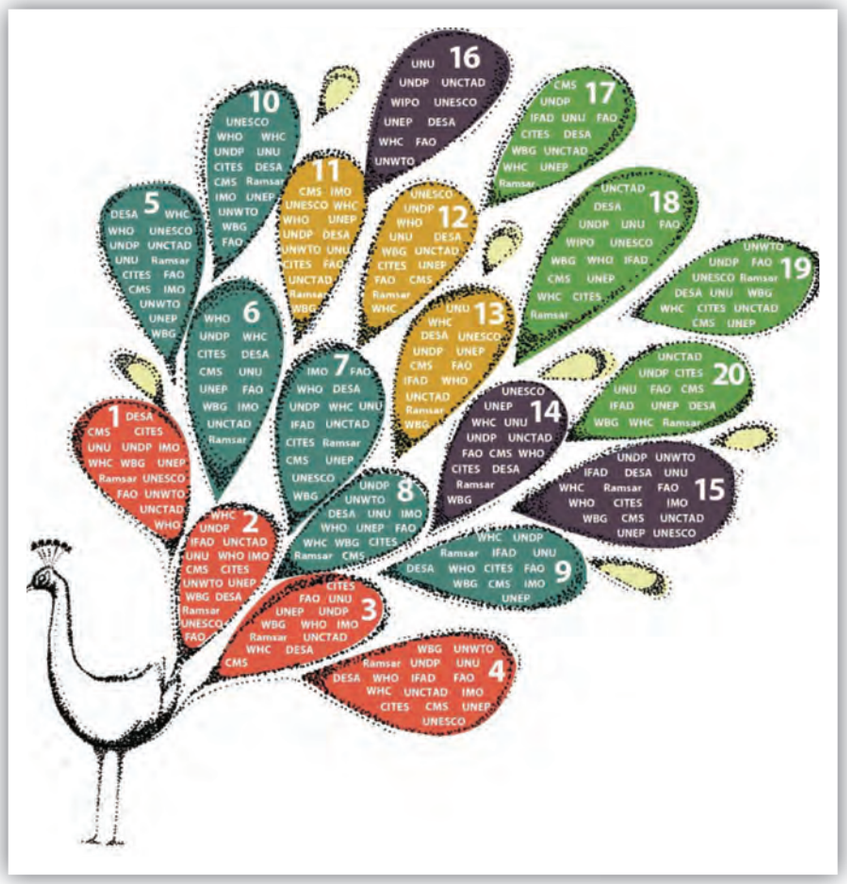


Figure 4.1 The UN system-wide contribution to the strategic plan for Biodiversity 2011-2020 (EMG 2013)

Though these numerous MEAs offer multiple opportunities to help deliver the Aichi Targets, countries currently report on weakened implementation of MEAs due to overloaded agendas, duplication of tasks, failed national coordination and intricate and arduous reporting procedures. Enhancing synergies across the implementation of biodiversity-related conventions and other MEAs at the national level could bring key benefits including reduced burden of national reporting, more efficient use of national expertise and capacity, amore integrated approach to collection and management of biodiversity data and increased consistency between national positions in different fora. All of these have the potential to deliver cost savings (UNEP-WCMC 2012, Box 33).

There is also scope for increased co-ordination across MEAs in mobilising resources. Such approaches will be most effective if they are supported by continued commitments to improved coordination and cooperation at the global level and if they are linked to the broad macroeconomic and development framework of the country in question.

Box 34 shows how the NBSAP process in Zimbabwe has been used as a significant cross-sectoral government planning tool to enable streamlining of implementation across all MEAs. In Uganda, a GEF steering committee includes focal points from all of the relevant conventions. It reviews projects and decides on allocation of resources. This avoids duplication of activities and offers scope for integrating biodiversity across other relevant focal areas.

Synergies with existing environmental policies could, in some cases, significantly reduce resource requirements

Box 33 Some key elements for enhancing co-ordination across MEAs at national level

- Collaboration of national focal points on NBSAP implementation, aided by appropriate mechanisms such as national biodiversity committees
- The inclusion of the objectives of other conventions in NBSAPs
- Alignment of policies and strategies for the non-CBD conventions with the NBSAP
- Joint development of national indicators for convention implementation
- Joint use of funding, in particular for national capacity-building for convention implementation
- Collaboration of national focal points and relevant agencies on national reporting to the biodiversity-related conventions and integrated management of national biodiversity management in support of reporting to, and implementation of, all the biodiversity-related conventions

Source: UNEP-WCMC (2012)

Evidence reviewed by the Panel shows that, where there are synergies between the Aichi Targets and existing policies that are well funded and well implemented, there is the potential for the additional resources required to meet the Aichi Targets to be substantially reduced. Box 35 discusses sectoral policies in the EU, where full implementation of the Water Framework Directive and related water legislation, and the Birds and Habitats Directives would make a significant contribution to the Aichi Targets.

Mainstreaming of biodiversity into wider policy agendas, plans and budgets, offers significant opportunities for more efficient policy-making processes and co-funding but it is still at an early stage

A more coordinated and coherent approach to planning and delivery between the biodiversity sector and other policy areas including development, growth, poverty alleviation, climate change, agriculture, forestry, fisheries, water and health, coupled with a more co-ordinated deployment of resources would help to address conflicts, deliver co-benefits and to meet the Aichi Targets at lower cost. This is as much about addressing negative impacts of wider policies on biodiversity (thus increasing the cost effectiveness of biodiversity spending) as opening up opportunities for funding from wider sources. Aligning national development sectors with biodiversity goals and with public and private expenditure priorities requires a nationally driven, inclusive and deliberative process that reviews existing policies and expenditures,

Box 34 Updating the NBSAPs in Zimbabwe

Zimbabwe is determined to use the NBSAPs revision as an opportunity to streamline biodiversity into national development policies. It has established a National Biodiversity Forum (NBF) consisting of five working groups: Forestry biodiversity, agro-biodiversity, protected areas, inland waters and wetlands and policy and legislation. These working groups will develop national targets, update the NBSAP and prepare national reports for MEAs. As a result, the revision of the NBSAP will be a participatory and inclusive process and will enable the NBSAP to become a significant cross-sectoral government planning tool. The NBF is complemented by the work of an inter-ministerial Task Team that monitors compliance with all international agreements.

Source: http://www.cms.int/sites/default/files/document/harare_november2012_report.pdf

determines costs and benefits of implementing biodiversity-related strategies and identifies a range of mechanisms and strategies to fill key finance gaps. This is central to the approach supported by the Biodiversity Finance Initiative - BIOFIN (Box 36). A more strategic approach to public budgeting could thus facilitate the co-funding of joint benefits between biodiversity and wider policy areas; whilst recognising

Box 35 The Aichi Targets and EU sectoral policy

Significant overlaps exist between EU environmental policies and the Aichi targets. Among the most significant of these are the Water Framework Directive and related water legislation (including the Groundwater Directive, the Marine Strategy Framework Directive, the Nitrates and Urban Waste Water Treatment Directives, Drinking and Bathing Water Directives). Overall, if these Directives were fully implemented, the water-related aspects of the Aichi targets would probably be met (e.g. pressure reduction: Targets 6, 7, 8, and contributions to Target 9, and 10; restoration targets 14 and 15; and targets 19 and 20). Several other targets are also related to these Directives, such as Target 4 (plans for sustainable production and consumption) and 5 (reduce degradation and fragmentation). Of similar importance are the Birds and Habitats Directives, which primarily tackle the conservation and restoration targets, i.e. the targets 5, and 11 to 15; through planning (e.g. Natura 2000 management plans), monitoring and research, and the obligation to raise the necessary funds. Implementation of these Directives would also contribute to Targets 4, 19 and 20.

The implementation of these legally binding Directives will be a priority for EU Member States, since infringement procedures can result in serious financial consequences for a non-complying EU Member State. However, it has been predicted that many Member States will fully exploit the given possibilities for exemptions and time extensions up to 2027 for objectives to be reached, which goes beyond the 2020 timeframe of the Aichi Targets.

Source: Regional report for Europe in CBD (2014)

Box 36 The BIOFIN approach to mainstreaming

In October 2012, UNDP launched the Biodiversity Finance Initiative – BIOFIN, a new global partnership to address the biodiversity finance challenge in a comprehensive manner – building a sound business case for increased investment in the management of ecosystems and biodiversity.

The initiative has developed and piloted a new methodological framework for undertaking national-level "bottom-up" analyses of the finance-relevant enabling context; for determining the current / baseline investment in biodiversity; for quantifying the full cost of meeting national biodiversity conservation targets and the resulting finance gap; and for assessing the suitability of financial mechanisms and developing national resource mobilization strategies that are fully appropriated by national governments and other key in-country stakeholders. This framework is being adapted and applied at national level, in 19 countries, led by their Ministries of Finance, Economics or Planning and the Ministry of Environment, and through implementation of the following components:

- Analysis of the integration of biodiversity and ecosystem services in sectoral and development policy, planning and budgeting
- Assessment of future financing flows, needs and gaps for managing and conserving biodiversity and ecosystem services
- Development of comprehensive national Resource Mobilization Strategies to meet the biodiversity finance gap
- Implementation of the Resource Mobilization Strategy at national level

This approach includes analysis of current policy and institutional frameworks affecting biodiversity and ecosystem services both positively and negatively, and quantification of related investments through comprehensive reviews of past and current (baseline) public and private expenditures. Analyses of impact, effectiveness and coherence will provide key opportunities for mainstreaming, aimed at reducing the cost of biodiversity management, such as through the removal of biodiversity-harmful incentives.

Box 37 Regional evidence on mainstreaming

Regional evidence reviews found that, despite some progress and positive examples, biodiversity remains, in many cases poorly integrated into wider development policy and national accounts. This is the case in both developed and developing countries.

In Africa, national development agendas are strongly focused on economic growth, and the Aichi Targets may still be perceived to be in conflict with this, especially where actions require reductions in outputs of certain sectors. Similarly, the critical welfare function provided by natural resources and many of the benefits of biodiversity are not recorded in national accounts. For example, in Madagascar, many of the country's coastal areas are very poor and rely on fisheries for food security. Officially, the fisheries sector contributed US$146 million in 2011, or nearly 2% of GDP, but this is based on a gross underestimate of the full effort and catches. There would be significant benefits from improving the management and sustainability of Madagascar's fisheries, for which properly accounting for the value of the resource will be essential (Le Manach *et al*. 2013).

A review of existing national reports and NBSAPs for Asia found that they do not generally report relevance to international agendas such as the Millennium Development Goals (MDGs). Where synergies are discussed, they generally appear in the form of lists that imply synergies rather than making them explicit.

In Europe, scope was identified for improved mainstreaming of biodiversity considerations into other policy realms such agriculture, forestry, fisheries, regional development and cohesion, energy, industry, transport, tourism, development cooperation, research and innovation. A need was also identified for integration of quantified biodiversity targets into rural development strategies and programs, integration of additional biodiversity concerns into the plant and animal health regimes, and greater integration into development policies with non-European countries. There is also a need for improved assessment of the impact of EU funded projects, plans and programs on biodiversity.

Source: Regional research reports in CBD (2014)

the 'biodiversity specific actions' that will need to be funded from biodiversity budgets.

Sustainable development is contingent on an enhanced common understanding of the positive and negative inter-linkages and dependencies between the conservation of biodiversity and its sustainable use in sectors such as agriculture, forestry, fisheries and aquaculture. In order to balance these two dimensions, there is a need to maintain the ecological infrastructure for regulating and cultural services on one hand, while allowing for the use of ecosystems for utilising provisioning services.

The section below discusses, in more detail, the evidence on mainstreaming and resource mobilisation, with a focus on poverty reduction and development policies. In addition, joint planning for biodiversity and climate change policies is discussed under Key Message 3, whilst the role of incentive reform for reconciling biodiversity and sectoral policy objectives is addressed under Key Message 8.

Aligning biodiversity, poverty reduction and development remains a priority

Though there are many positive examples of alignments between biodiversity and wider policies and efforts to mainstream biodiversity into poverty elimination and development, the Panel found less evidence that showed an explicit link between mainstreaming efforts and a positive result for resource mobilisation, and identified this as a key area for further work. This would include publication and dissemination of evidence and case studies from BIOFIN and other relevant initiatives.

Box 38 shows how countries working with the Poverty and Environment Initiative (PEI) have mainstreamed poverty-environment considerations into development plans, with positive impacts on budgetary allocations.

In India, the Mahatma Gandhi National Rural Employment Guarantee Act (2005) was envisaged to provide guaranteed employment in rural areas

Box 38 Mainstreaming biodiversity through the Poverty-Environment Initiative

The 'Economic Valuation of Natural Resources Study', supported by PEI, demonstrated the benefits to development of resource management in Malawi in four areas - forestry, fisheries, wildlife and soils. In response, the Government plans to invest about US$59 million in environmental programmes in the next 5 years; has integrated poverty-environment criteria into its executive decision making processes and across sectors; and has included a chapter on environmental sustainability in its 2014/15 budget guidelines. This is focused on ensuring that all projects comply with environmental sustainability guidelines and on securing benefits from sustainable resource use and management.

Pilot local governments in Thailand have increased budgetary allocation to sustainable development in response to their participation in the Sub-Global Assessment on Ecosystems and Human Well-being. In 2012, Nan's provincial agriculture office adopted four agricultural scenarios developed through the SGA to be used as a basis for formulating its next provincial agricultural plan 2014–2020 and the provincial administration organization has allocated US$50,000 annually since 2010 to improve community land management. Bua Ngeon, a sub district of Khon Kaen, used economic valuation methodology to advocate for funding to protect and conserve its forest from food and energy crop plantations. The local administration allocated US$100,000 to create a natural road between the encroached community forest and farmland after realizing the important value the forest provides to the wellbeing of the local poor community

Source: UNDP-UNEP (2014)

and thereby alleviate poverty. It is the largest social security scheme in the world and has created more than five million green jobs in activities such as afforestation, water harvesting, soil conservation and land development. With a total outlay of approximately US$6 billion in 2012-13, the scheme has also empowered vulnerable sections of society, with more than one-third of the jobs in 2012-13 allocated to women and more than two-fifth of the jobs allocated to other vulnerable groups. Such activities thus have the potential to deliver joint benefits of empowerment, poverty reduction, employment, creation of green infrastructure (thereby providing resilience against shocks which may impact the poor) and biodiversity conservation.

Box 39 provides an example of integration of biodiversity considerations into development support in Belgium.

Efforts to capture the broad range of biodiversity values in accounting and reporting systems can contribute significantly to resource mobilisation efforts

The examples in Box 38 illustrate the critical role that the assessment and valuation of ecosystem services and natural capital have had in mainstreaming of the environment and biodiversity and in the allocation of budgets. Additional evidence from Africa strongly supports the rationale for investments in national

Box 39 Belgian Export Credit Agencies

A concrete operational objective of Belgium´s national planning document towards biodiversity protection (from 2006) is to take biodiversity concerns into account in providing financial support (loans, guarantees, insurance) for projects in Southern and Eastern Europe, through the Export Credit Agencies (which help Belgian industries abroad). The projects supported by the Agencies - mainly infrastructure projects, such as dams and pipelines - can have very significant impacts on environment and biodiversity, which would need to be fully incorporated into any applications for support through the agencies - screening procedures "must ensure that activities that lead to irreversible damage to biodiversity are not promoted".

Source: CBD 2013

Box 40 Use of Ecosystem Service Values in the South Pacific

a) South Pacific ecosystem service valuations have been used by a varied list of stakeholders:

b) Development banks, for which ecosystem service valuations intend to highlight how conservation has helped the local or regional economy and the people who depend on the managed ecosystems (e.g. the cost-benefit analysis of community based marine managed areas in Vanuatu).

c) Environmental agencies and conservation NGOs that need to justify "why do we need conservation here?" when arguments regarding the pristine nature and uniqueness of ecosystems are considered insufficient (e.g. valuation of the costs of wild versus cultured live corals to inform public policy, Lal and Kinch, 2005).

d) Government planners to whom it is then suggested to incorporate "green" welfare accounting in their monitoring and planning activities, so as to change the compass, as is suggested by TEEB (2011), and just promoted, during Rio+20, in UNEP's "Inclusive Wealth Index" (UNU-IHDP and UNEP, 2012). An example of this application is the use of the World Bank natural capital accounting approach in New Caledonia (Brelaud *et al*. 2009).

e) Environmental government agencies that intend to assess and communicate the ecosystem services that their actions protect or improve. For instance, the results of a Total Economic Valuation (TEV) study in New Caledonia were used by the local environmental department to influence budget allocation.

f) Last, local stakeholders such as customary chiefs or Marine Protected Areas managers can use the results to highlight benefits for the local users and members of the community. For example, a Fiji and Vanuatu Managed Marine Area valuation helped put forward benefits and equity distribution that, perhaps, were not perceived by the inhabitants. They were used as a tool in the community for making trade-offs between the short and medium term.

Source: Regional report for Australia and the Pacific in CBD (2014)

assessments and accounting for biodiversity values. For example, in South Africa, the Durban municipality started to invest more in natural capital after a very broad-brush valuation of its ecosystems using benefit transfer methods (Boon 2010). In Namibia, a relatively simple assessment of the value of investing in the protected area system led to a capital injection of US$100 million (Turpie *et al*. 2012). The following box shows how ecosystem service values have been used to influence different stakeholders and policy agendas in the South Pacific.

Initiatives such as The Economics of Ecosystems and Biodiversity (TEEB), the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) partnership, the ongoing development of statistical standards for environmental economic and ecosystem accounts from the United Nations Statistics Division and planned studies under the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES), as well as related work at national and regional levels, are expanding the toolbox for capturing the range of values from biodiversity and ecosystem services in decision making. Increased use of such tools in support of improved decision making in public and private sectors may significantly contribute to long-term human well-being and sustainability.

Box 41 The WAVES initiative in Madagascar

Madagascar is one of the countries partnering in the WAVES initiative. The main objective of this initiative is to attain sustainable development through integrating the values of natural resources into national accounts. This approach will allow the incorporation of natural capital accounting in the political analysis and development planning of Madagascar.

Madagascar WAVES comprises 5 working areas: i) macroeconomic indicators ii) mining resources accounting iii) water resources accounting and water resources integrated management planning iv) protected areas and forestry ecosystems enhancements and v) fisheries resources accounting and integrated management of coastal areas. An integrated action plan for each sector will be developed. Simultaneously a capacity building programme will be established to provide actors with the necessary skills and knowledge for the sustainability of WAVES results. The accounts to be established within each sector are shown below:

Accounts to be established within each sector

Sector	Public policy concerns	Priority accounts	Secondary account from a conceptual/ methodological endeavor
Mining	i) Increase mining sector contribution to the economy of Madagascar; ii) Equal sharing and effective reallocation of mining incomes to beneficiaries; iii) Mining development and environmental management balance	Stock accounts (monetary and physical) for industrial minerals	Stock accounts (monetary and physical) for precious stones and gold
Water resources	Efficient management of water (sustainable balance between availability and utilization of water resources)	Flows accounts for a catchment in the north of the country	Stock accounts of water resources renewed for a catchment in the north of the country
Forestry	i)Forestry sector contribution to the national patrimony ii) delivery of goods and services from forest ecosystems iii) Sustainable financing of protected areas network	Stock accounts (monetary and physical) for exploitable forestry resources in non-protected forests	Limited physical and monetary stock accounts for protected areas

Several macroeconomic indicators that are suitable to Madagascar have been identified by the Ministry of Economy and Industry and the Macroeconomic GTT, including 'natural wealth values', 'natural resources depletion level index' and 'adjusted net saving' (ENA).

Box 41 shows how the partnership between Madagascar and the WAVES initiative will facilitate the incorporation of natural capital accounting in the political analysis and development planning of Madagascar.

The strengthened science-policy interface for biodiversity and ecosystem services could be a critical force in shaping the governance system for mainstreaming

Effectiveintegration of biodiversity and ecosystem services concerns into other sectors and their plans for resource use and investments will require a full understanding and recognition of their relevance and value to those sectors. To date, information on the relevance and value of biodiversity and ecosystem services to other sectors has tended to be provided in a piecemeal manner, and through a range of different processes. With the establishment of IPBES and the

adoption of its first work programme, there is strong potential for presenting information on the relevance and value of biodiversity and ecosystem services in a coherent manner, and through processes that are recognized by both the knowledge sectors and governments alike. This will include new and improved methods for conceptualising the many values of biodiversity and ecosystem services, the use of these methods across all IPBES assessments, and the development of policy support tools that aid in their application at all levels. IPBES aims to provide assessments that support governments and other stakeholders in recognising and understanding the value of biodiversity and ecosystem services. It also aims to deliver policy support tools that help in applying that knowledge, and to build capacity in further developing and using that knowledge.

4.7 Key Message 7:

All countries need to invest in institutions and policy frameworks, direct conservation and sustainable use actions, incentives and economic instruments.

Cohesive, well-designed institutions and effective policy frameworks are a prerequisite for effective and efficient biodiversity financing systems.

Countries need to invest in direct conservation and sustainable use actions, in developing incentives and economic instruments, and in technology. They need to address the underlying drivers of biodiversity loss.

There is a need to respect and learn from indigenous peoples and local communities' knowledge and their contribution to the sustainable use and conservation of biodiversity, including recognising property rights and enhancing their participation and involvement in planning and implementation processes.

A range of investments are needed to meet the Aichi Targets

To meet the Aichi Targets, all countries need to invest in institutions, policy and multi-level governance frameworks, direct conservation actions, incentives and market measures, technology and infrastructure. The balance of priorities varies by region.

The Aichi Targets are ambitious, and meeting them is dependent on significant levels of investment in natural capital, as well as recurring expenditures on maintenance and management activities over time. A typology of investment needs is presented in Table 4.9.

Table 4.9 Typology of investment needs

Category	Types of investment required	Relevant Aichi targets
Institutions, policy frameworks, capacity and knowledge	Governance structures and institutions Plans and strategies Training and capacity building Research and monitoring Education and awareness raising Accounting and reporting systems	All Targets
Direct conservation actions	Acquisition of land Legal protection and enforcement measures Site management Control of IAS Restoration of ecosystems Species conservation measures Conservation of genetic diversity (*in situ* and *ex situ*)	5, 7, 11, 12, 14, 15 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 9, 11, 12, 14, 15 6, 10, 14, 15 6, 11, 12, 13 13, 16
Incentives and market measures	Reform of perverse incentives Development of positive incentives Allocation of property rights Standards and certification	3, 7, 14, 15 3, 5, 6, 7, 8, 10, 11, 14, 15 5, 6, 7, 11 4, 5, 6, 7, 8, 11, 14, 15, 16
Technology and infrastructure	Control of pollution through environmental infrastructure and technologies Technologies for sustainable agriculture, forestry, fisheries and aquaculture	5, 8, 10, 11 5, 6, 7, 8, 10, 11

The HLP first report identified investment needs for each of the Strategic Goals and Aichi Targets

In its first phase report, the High-Level Panel recognised that it could not prejudge how countries will aim to meet the Aichi Biodiversity Targets, and therefore that it was not possible or appropriate to specify a detailed global operational plan for meeting them. Instead, the research sought to define plausible scenarios consistent with Target implementation, in consultation with experts, which provided a broad indication of the scale of activity required globally while recognising the varying needs of different countries.

The types of investments identified by HLP (2012) varied significantly across the Targets and strategic goals:

- For Targets under Strategic Goals A and E, as well as Target 16 (Nagoya Protocol), the research highlighted the need for investments in policy frameworks and initiatives, and related research, capacity building and communications. Most investments are required at the country level, though there is also a requirement for scientific research internationally.
- For Targets under Strategic Goal B, much of the investment needed is likely to be in incentive measures designed to reduce pressures on biodiversity and promote sustainable use, as well as supporting capacity building, management, training, monitoring and enforcement activities. Significant capital investments will also be needed in pollution control, wastewater treatment, sustainable aquaculture systems and control of invasive alien species.
- Strategic Goal C calls for targeted investments to establish and maintain protected areas, and to conserve species and genetic diversity. This will require a range of incentives, compensation payments, land management actions, planning, capacity building, management and enforcement activities.
- Strategic Goal D will require significant capital investments in restoration activities for forests and wetlands, followed by ongoing maintenance actions.

A summary of types of investments identified by Target in HLP (2012) is given below.

Table 4.10: Summary of types of investments required to meet each of the Aichi targets

Target	Types of investments/activities identified
Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
Awareness Raising	Country level investments in strategies and surveys; ongoing events, training, education and campaigns
Biodiversity Values	Country level investments and ongoing work on national TEEB studies, policy integration work and national accounting initiatives
Incentives	Country level investments in studies on negative and positive incentives, capacity building; ongoing work to reform negative incentives
Sustainable Production and Consumption	Country level investments and ongoing expenditures on studies, action plans and public procurement measures
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
Reducing Habitat Loss (forests and wetlands)	Forests: Investments and ongoing expenditures on incentives, also inventories, monitoring, training, law enforcement Wetlands: Investments and ongoing expenditures on offsets, PES, land acquisition, site designation and management
Fisheries	Investment in incentives to reduce fishing effort; ongoing expenditure on management and enforcement
Sustainable Agriculture, Aquaculture and Fisheries	Agriculture: investments and recurrent expenditures on policy and institutions, R&D, extension, restructuring, certification, changes in practice Aquaculture: investment and ongoing expenditures on integrated and closed containment systems, capacity building and mangrove restoration Forests: investment and ongoing expenditures in public procurement policies, processing efficiency, fire management, market development (tourism, PES, carbon, ABS)
Pollution	Investment in biodegradable plastic production, wastewater treatment, pollution control, green infrastructure; ongoing expenditures on marine debris clean–up, enhanced agricultural management
Invasive Alien Species	Investments and ongoing expenditures on research and prioritisation, control and eradication measures, measures to prevent new introductions (including policy and capacity).
Coral Reefs	Ongoing management activities: integrated coastal zone management; sustainable marine resource use (e.g. fisheries); integrated watershed and wastewater management; marine protected areas
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	
Protected Areas (terrestrial and marine)	Investments in establishing PAs (especially compensation) and ongoing management actions (including incentives and staffing)
Species conservation	Ongoing actions involving site and habitat protection; restoration and management; control of invasive alien species; species management and recovery actions; trade/ harvest management; *ex situ* conservation; introduction/reintroduction; and education and awareness–raising.
Genetic diversity	Mostly one-off investments in *ex situ* maintenance and expansion of existing collections; economic incentives for *in situ* conservation by farmers; capacity–building in developing countries.
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	
Ecosystem restoration	Capital investments and ongoing management activities to restore wetlands and coral reefs
Restoration of forests	One-off investments and ongoing expenditures: site selection; seeds, nursery establishment, planting; assisted natural regeneration; site protection; weeding
Nagoya Protocol	One-off investments in policy and institutional frameworks

Target	Types of investments/activities identified
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
NBSAPs	One-off investments in developing and updating plans at national level
Traditional Knowledge	One off investments in national level strategies and capacity building measures
Science Base	Research, monitoring and information systems at national, regional and global levels. Regional and global research cooperation. Global modelling and analysis, science–policy interface actions.
Mobilisation of Financial Resources	One-off investments at country level to develop and implement resource mobilization strategies and reporting frameworks.

Source: HLP (2012)

Regional evidence supports the needs identified in the HLP first report

In general, regional evidence tends support to the suite of investment needs identified in HLP (2012) and summarised in Table 4.10. The top-down assessment presented in HLP (2012) was generally found to be consistent with identified priorities at national and regional level, and no significant differences could be found.

Regional evidence points to the following priorities with regard to the main types of investments required.

Institutions, policy frameworks, capacity and knowledge

Investing in policy frameworks and general enabling conditions is a pre-requisite for biodiversity action in many countries, and especially in less developed parts of Africa, Asia, Latin America and the Caribbean and Eastern Europe. Actions to raise awareness, build capacity, develop the knowledge base and establish the necessary legal structures, institutions and governance frameworks are a prerequisite for effective delivery of all of the Aichi Targets, as well as contributing directly to Targets 1-4 and 16-20. In more developed regions, such as North America, the EU and Australasia, enabling frameworks are generally more developed, but much progress still needs to be made in raising awareness of the value of biodiversity, improving understanding of ecosystem services, and integrating knowledge and awareness into incentive mechanisms and decision making processes.

Investment in mainstreaming biodiversity into other policy areas is a key priority for all regions. Arguably, there are greater opportunities for doing so in less developed regions where institutional structures and legal frameworks are still being formed. Since there is inadequate funding for biodiversity action in many countries, opportunities to integrate biodiversity with other policy agendas related to poverty alleviation, sustainable livelihoods and natural resource management are important. For example, the Poverty Environment Initiative in Bhutan focuses on integrating environment, climate and poverty into Bhutan's policies, plans and programmes and budgets to achieve a greener, more inclusive and sustainable development path.

Direct conservation actions, and associated technology and infrastructure

Investing in protected areas is highlighted as an important priority in all regions. It is particularly important for many less developed regions, which support a large proportion of the world's biodiversity and where many ecosystems remain relatively intact. Moreover, in areas where other strategies continue to falter, terrestrial and marine protected areas remain a core strategy for conservation, in spite of the political opposition they often face. This is relatively costly, but carries a low level of risk, and the returns are fairly certain. The effectiveness of protected areas depends on adequate investment in protection and management activities, and it is clear that this requires substantial increases in investment over current levels, particularly in regions where existing protected area networks are not well managed. The effectiveness of protected areas is also vitally dependent on the establishment of the right enabling conditions (e.g. awareness, governance frameworks, monitoring and enforcement mechanisms, involvement and support from local institutions and communities). Increasing investment in land management is also a widespread priority for many protected areas. For example, while the Natura 2000 network now accounts for 18% of the EU land area, less than a quarter of this land is in favourable conservation status, highlighting the need

for investment in appropriate management actions. In addition, to ensure the success of many protected areas, large investments will need to be made in promoting conservation in buffer and corridor areas.

Achieving sustainable forestry, agriculture and fisheries is a priority in all regions, and especially important in less developed regions given the significant reliance of communities on these activities for their livelihoods. In Africa, a large proportion of biodiversity loss is due to agricultural expansion, and unsustainable harvesting of forest, fish and wildlife resources, including overgrazing. The sheer area that has to be covered, coupled with the fact that the interventions involve intensive and lengthy stakeholder processes, mean that the investments need to be large if they are to have a significant impact.

Ecosystem restoration is a particular priority in those countries where a large proportion of land has been adversely affected by development and human activity. For example, the EU Biodiversity Strategy has established a target to restore 15% of degraded ecosystems, which will require substantial investment. Restoration tends to be less of a priority in regions where there are larger areas of less spoilt ecosystems that remain under threat.

Incentives and market measures

Investment in development and reform of incentive mechanisms is important in all regions. Addressing harmful subsidies and perverse incentives will help both to mitigate adverse impacts on biodiversity and to free up scarce financial resources. Developing positive incentives is important everywhere, and in developing countries is essential to achieve biodiversity goals and to ensure that potential distributional impacts are managed.

There are regional differences in priorities for investment

The regional reviews indicate some differences in priorities and emphasis between regions. The specific actions and investments required to deliver the Targets have not been centrally defined, and will vary between countries and regions and according to local needs, priorities and approaches. There will also be variations in the delivery mechanisms for the required investments. For instance, community based management schemes tend to be more important in developing than in developed countries.

Examples of some of the key priorities highlighted by the regional reviews include:

- In **North America**, eliminating harmful subsidies is considered an important priority as it would not only reduce pressure on biodiversity but also free up funds that could be directed to other investments. The need to integrate biodiversity and natural capital accounting into governmental and non-governmental decision-making is also stressed.

- In **Europe**, the need to ensure a better uptake and distribution of existing funding mechanisms is stressed. Restoration of degraded ecosystems is a key priority in Western Europe, while conservation of more intact forests and grasslands is important in Eastern Europe and Russia, where there is also a significant need for capacity building, research, awareness raising and the development of legal and enforcement structures.

- In **Latin America** a strong focus is put on the establishment of sustainable financing mechanisms for biodiversity such as payment for ecosystem services and the establishment of water funds. Through these mechanisms a range of actions is targeted such as protected areas management, sustainable agriculture and livestock production.

- In **Asia and Africa**, priorities relate to issues typically faced by developing countries such as:
  - The need to mitigate the biodiversity impact of uncontrolled urban and infrastructure development;
  - The necessity to address local pollution issues, for reasons of public health as well as biodiversity conservation. There is a need to cleanup freshwater and marine resources, tackle local pollution caused by commercial activities, and invest in wastewater treatment and environmental infrastructure;
  - The need to integrate biodiversity action with development policies.

With regard to the different Aichi Targets, it is clear that:

- Some investments apply to all countries and need to be made reasonably evenly across the world (e.g. most Targets under Strategic Goals A and E);

- Some Targets relate to habitats that are geographically restricted and require investments to be focused in particular areas (e.g. Target 10 – coral reefs);

- Some Targets are widespread in their coverage but are likely to require uneven levels of investment, because of:
  - Differences in existing pressures and needs (e.g. Target 8 – pollution, Targets 14-15 - restoration);
  - Differences in the extent of progress and activity to date (e.g. Target 11 - protected areas); and
  - Differences in biodiversity richness and conservation requirements (e.g. Target 12 – species conservation).

The boxes below present examples of priorities for biodiversity conservation in different parts of the world. Investing in the right enabling conditions and institutional frameworks is a priority in many less developed regions (Box 42).

Examples from Africa demonstrate that the effectiveness of marine protected areas depends on efforts to raise awareness among stakeholders, and to develop effective institutional and policy frameworks (Box 43).

Box 42 Investing in the right enabling conditions is a priority in many less developed regions

In Guatemala, more than half (54%) the NBSAP budget is dedicated to improving coordination, institutions and awareness levels. From the total budget for the NBSAP (approximately US$291 million), 37% will be invested in territorial institutions and coordination of actors, and 17% in awareness and valuation assessment. The remainder is dedicated to sustainable landscapes and planning for conservation (39%), the prevention of threats (5%) and the restoration of biodiversity and ecosystems services (5%).

In many Pacific Islands, coastal fisheries must compete with other important sectors for a share of public funds and in general have not received substantial funding from national fisheries agencies or sub national governments. Sub national governments often have the discretion to allocate funding to fisheries and coastal marine management, but these allocations are typically very small. Even if local leaders believe coastal marine management is important, they often lack the technical capacity to secure the necessary resources through budgeting processes or the ability to manage coastal marine resources. The end result is funding flows that are based primarily on the prior year's budget rather than on a critical assessment and balancing of priorities.

In Madagascar, a key priority of the WAVES (Wealth Accounting and the Valuation of Ecosystem Services) initiative has been to develop macroeconomic indicators like adjusted net savings and adjusted net national income to assess whether Madagascar is building or depleting national wealth. Establishing systems which account for biodiversity values is of particular concern in developing countries, where natural resources and the natural environment constitute 21-35% of total wealth (Hamilton 2013). The sectors that were identified in Madagascar for creating detailed accounts include the mining sector, fishing sector, tourism, and water (WAVES 2012).

In the drylands of **West and North Africa**, the success and sustainability of conservation efforts on communal and private lands will depend on public awareness and understanding of biodiversity by farmers, and the incentives that will be provided by governments to make conservation profitable. For example, Solh *et al.* (2003) claim that a broad public awareness and education campaign at all levels, starting with the community members and school children and addressing other stakeholders, particularly national decision- and policy-makers and donor organisations, will be essential for arresting and, hopefully, reversing biodiversity degradation.

Developing strong and sustainable local institutions is essential to achieving long term success in the establishment of protected areas. This was the conclusion of a review of three protected area projects in **East Africa** (Bwindi Impenetrable National Park and Mgahinga Gorilla National Park Conservation Project, Reducing Biodiversity Loss at Cross-Border Sites in East Africa Project, and the Lewa Wildlife Conservancy Project). Strong institutions provide the necessary continuity and fund-raising capability to consolidate and scale up the project activities after project closure. This is especially important when dealing with integrated conservation and development initiatives, which take many years to achieve significant livelihood benefits l*et al*one global environmental impacts. Since the typical length of a GEF project (3-5 years) is insufficient time to develop sustainable community-based institutions and new conservation-compatible livelihood strategies, continued support is needed to consolidate and develop these (GEF Evaluation Office 2008).

Box 44 highlights some of the investments required to promote sustainable forestry, agriculture and fisheries in different countries in Asia. Box 45 illustrates the wide range of investments needed in order to enhance the sustainability of fisheries, forestry and agriculture in Africa.

Box 43 Awareness raising and effective institutions are vital for successful MPAs in Africa

In **Senegal** the Narou Heuleuk Project was implemented to protect fishing resource and enhance biodiversity in four sites along the coast. In the end, only one MPA was established at one of these sites. The reasons for failure were given as lack of local community involvement, and lack of political commitment. This highlights the importance of raising awareness among decision-makers about the benefits of biodiversity conservation. Importantly, it demonstrates the need for community involvement.

In **Tanzania**, in spite of having agreed to the creation of the Mnazi Bay MPA, local villagers have been reticent to cooperate, partly because of a number of unfulfilled promises but also because of political differences. Over the course of the project, this escalated into outright hostility and rejection of the MPA and its rules. Part of the reason for this was thought to be the weak institutional context and management unit, and inadequate technical support for the project.

In **Mozambique**, the creation of the Quirimbas National Park project benefited from a favourable legislative environment, the political will to make the conservation sector a driving force of the economy, support of the local communities who wanted the park in order to conserve their resources and reduce conflicts with migrant fishermen, good technical support for the management unit and well-coordinated partnership between co-funding agencies. However, failure to involve the Ministry of Fisheries in the project led to many problems that were only resolved after 5 years.

Source: Gabrié et al. (2010)

Box 44 Sustainable forestry, agriculture and fisheries in Asia

While not all National Reports and NBSAPs of Asian countries specifically identify where investments should be focused, the regional review for Asia found that priorities for the region include developing baselines for biodiversity (including species information, status and distribution range), sustainable collection of NWFPs, preservation of crop genetic diversity, wetland conservation, species conservation, reducing fragmentation, developing community-based natural management regimes, building human and technical capacity for biodiversity conservation, integration in public policy, coastal zone management, sustainable rangeland management, soil and watershed conservation, sustainable tourism, sustainable fisheries management, and biodiversity monitoring. These activities have also been identified in the National Capacity Needs Self Assessments for different countries.

Bangladesh has identified priority programmes such as Sustainable Ecosystem Management Programme, Community-based Fisheries Management, Coastal & Wetland Biodiversity Management Project, and Coastal Afforestation Programme among several others with specific investment estimates for each of these activities which total to US$360 million for a period of 2010-20.

With a budget of US$10 billion over a ten-year period, **India** has launched the Green India Mission (GIM) with the objective of doubling the area for afforestation/eco-restoration to 20 million ha, improve ecosystem services, biodiversity and carbon sequestration in 10 million ha, and increase forests-based livelihood incomes for 3 million forest-dependent households. India has developed a national programme to combat desertification, with an estimated investment of US$20 billion.

Priorities in **Nepal** include strengthening legislation, conservation of endangered species, developing eco-friendly rural tourism, managing non-wood forestry projects and exploring marketing opportunities for poverty reduction, for which an estimated US$86 million will be required.

Box 45 Sustainable fisheries, forestry and agriculture in Africa

In many African countries, the **industrial marine fisheries** have been overexploited through profitable relationships with foreign fishing fleets. A large part of the problem is selling out of ocean fishery resources to foreign fleets. In Namibia, lessons from the introduction of sustainable fisheries management are that (1) putting resources and technology into monitoring is essential, (2) management strategies need to cope with the underlying variability in fish stocks; and (3) sustainable marine resource management relies on collaboration with neighbouring states (CBD 2011). In addition, certification systems can be a useful tool for these fisheries. A reduction of effort can also be achieved using buyouts. Buyouts are effective when capital investment in fisheries is high, making exit difficult. This measure is therefore mainly applied to more industrial fisheries, but could also apply to small scale commercial fisheries. The initial cost is high, but it presumably leads to savings in management costs in the long run. Buyouts have not yet been attempted in Africa.

In Lake George, **Uganda**, overfishing was ascribed to the low price of fishing licenses, and associated limited monitoring and enforcement capacity, and resultant widespread illegal fishing. In 1998 an effort was made to remedy the problem by increasing the number of fishing licenses, raising fees and using some of the revenues for management under a co-management arrangement. However, the number of illegal fisherman was only temporarily reduced, as the prices became outdated. In a high growth environment, co-management arrangements need continued investment in order to be effective (CBD 2011).

Inshore coastal and floodplain fisheries are also of particular importance in terms of biodiversity and contribution to people's livelihoods. Although politically unpopular, MPAs are an important way of dealing with inshore fisheries problems, because they provide a means of controlling access and hence effort. One of the currently popular interventions is the establishment of locally managed marine areas, which are broader than the older concept of territorial use rights in fisheries (TURFs). The costs of LMMAs reportedly range from US$42 to US$2,000 per km^2 of managed fishing ground (Harding *et al*. 2012).

The commercial **exploitation of forests** in Africa is not well regulated and has been highly damaging to biodiversity, especially by opening up access to previously remote areas(Bennett *et al*. 2002). These problems are particularly severe in the tropical forest regions, but also extend to the dense woodland areas as far south as **Zimbabwe and Mozambique**. This area is one of the highest priorities for intervention. Apart from strict protection, the main types of interventions required include:

- the elimination of harmful subsidies;
- better monitoring and management involving strict standards, regulation and enforcement, and reducing corruption;
- certification; and;
- increasing processing efficiency.

In **Ethiopia**, the seed industry is monopolised by a state-run supplier focusing mainly on selling improved and hybrid varieties, and there is also no supply of local varieties (which hampers progress in achieving Target 13). Farmers therefore meet their needs through informal exchange systems, as occur in many parts of Africa, but only to a limited degree because of the belief that everyone has the same crops and varieties. A community seed bank project has been successful at integrating the traditional styles of obtaining seed through exchange, but providing a greater choice of sources of seed, contributing to the management of agro-biodiversity, seed security and improved welfare for farmers, and also ensuring *in situ* conservation of genetic diversity (Atilaw and Korbu 2011, Fukuda 2011). This provides an example of acost-effective intervention through supporting decentralised projects in order to circumvent central government inefficiency.

In **Zambia**, the Community Markets for Conservation (COMACO) model was developed in the Luangwa Valley, to promote and maintain sustainable agricultural and natural resource management practices among

Box 45 *Continued*

the communities surrounding national parks. The least food-secure households are identified and trained in sustainable agricultural practices that minimize threats to natural resources while meeting household needs. In addition, people responsible for severe natural resource depletion are identified and trained to generate alternative income. In 6 years, the 60 extension staff have trained more than 40,000 farmers, 19,000 of whom are registered as having completed training and being compliant with Conservation Farming practices. The project had involved considerable investment, including construction of a trading facility, building of local depots, etc., amounting to some US$740,000 (Lewis *et al.* 2011), but was not yet financially self-sustaining in 2010.

Certification provides another opportunity to increase the profitability of farming systems. In particular, investing in organic production and marketing may represent a cost-effective investment in livelihood improvement through access to lucrative organic markets. Many African production systems would be relatively easy to convert to recognised organic systems, and there is provision for a shorter conversion period for land that has a history of minimal agrochemical use. However, indigenous systems have been eroded with the advent of the Green Revolution, and capacity-building would be critical for success (Juma 2007). Nevertheless, the cost of organic certification is high. In **South Africa**, costs vary between US$900 and US$1,500 per annum. Government intervention, such as subsidized organic certification and facilitation of group certification among smallholder farmers would be vital to promote local organic production (Thamaga-Chitja and Hendriks 2008).

The type and scale of investment needs reflects the level of progress towards the achievement of the Aichi Targets, which varies by region and by target

Some regions have a longer track record in biodiversity policies and actions than others. Unsurprisingly, the more developed regions are often better placed to meet the Aichi Targets than the less developed regions, where resources are lacking, ongoing pressures on biodiversity are often greatest, and where more action is often required.

Similarly, there is also greater progress on some of the Aichi Targets than others. Overall the regional evidence reviewed by the panel suggests that the most progress has been made across the regions on Targets 11 (protected areas) and 12 (species conservation). Considerable progress is also being made in some regions on some of the other Targets, such as on Target 1 (awareness raising), Target 2 (accounting for biodiversity values), Target 17 (developing NBSAPs) and Target 19 (knowledge, science and technology).

However, there are other areas where progress is lacking and where there have been lower levels of achievement. This relates especially to those Targets which seek to reduce direct pressures on biodiversity from forestry, fisheries, agriculture, and invasive alien species (Targets 5 through 10). Other areas are also proving difficult, such as the reform of incentives and subsidies (Target 3), sustainable production and consumption (Target 4) and ecosystem restoration (Targets 14 and 15).

These are, however, generalisations and there are considerable variations within and between regions. This variation is evident from an assessment in Latin America and the Caribbean, where countries estimated their level of achievement of the Aichi Targets (shown below). Even from this chart, however, it is clear that progress tends to be greatest in areas of traditional conservation activity (Targets 11 – Protected Areas; 12 – Species Conservation; and 19 – Science Base).

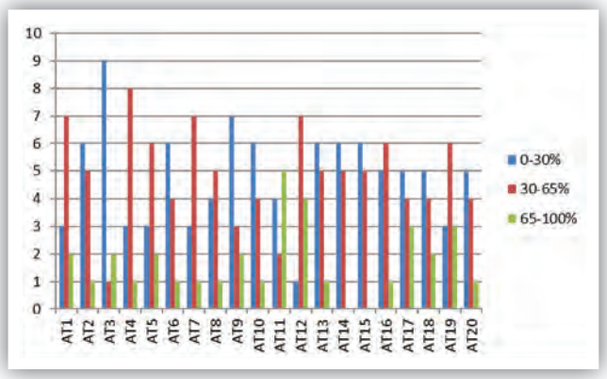


Figure 4.2 Number of LAC countries estimating levels of achievement of Aichi targets*

AT denotes Aichi Targets.

Source (UNEP-CDB 2013)

(*) This figure does not include information from Costa Rica, Colombia, Ecuador, Guatemala or Peru.

The types and scale of upfront versus on-going expenditure will potentially be different in different regions

HLP (2012) examined both the up-front investment and the recurrent expenditures needed to meet the Aichi Targets. It was estimated that up-front investment needs were greater, accounting for 60-70% of overall resource requirements in the 2013-2020 period. Evidence from the regions suggests that the balance of these may vary between countries and regions, because of variations in:

- Institutional structures and enabling frameworks. The need for up-front investment may be greater in many developing countries, where the necessary structures and frameworks are not yet in place, than in more developed regions, where ongoing management actions may be relatively more important.
- Priorities for biodiversity action. In those areas where ecosystems are heavily degraded, which particularly include more developed and heavily populated regions such as Western Europe, capital investments in restoration activities are relatively important. Countries with larger areas of more intact ecosystems are more likely to prioritise ongoing protection and management actions.

Investments need to reflect the synergies between different Aichi Targets

Overlaps between the different Aichi Targets mean that there are synergies between the investments needed to achieve them. Investments in enabling targets will support action in pursuit of other targets and lower the cost of achieving them. Some investments will contribute to the delivery of more than one target. HLP (2012) noted that simultaneous actions designed to meet each Target independently would be unlikely to be a cost-effective approach to meeting the Aichi Targets. Understanding the inter-linkages and co-dependencies is important in order to prioritise and appropriately sequence the actions required, and therefore help to reduce overall resource needs (Box 46). It is also important to understand time lags when prioritising actions (CBD, 2014).

Box 46 Examples of synergies in investments to meet the Aichi Targets

Investment in **Target 1** (awareness of biodiversity value) is fundamental to integration into development planning (**Target 2**) and is also an important strategy to achieving many of the other Targets. In turn, **Target 2** links to many of the other Targets by helping to establish a favourable policy and institutional framework for their delivery.

Investments in plans for sustainable production and consumption (**Target 4**) will play an important role in the success of **Targets 5-10** over the longer term.

In arid countries better agricultural technologies **(Target 7)** and treating waste water **(Target 8)** will play a big role in increasing the conservation of water resources. Achieving these Targets would reduce the pressure on freshwater aquifers and inland water bodies (**Target 11**), and that may benefit wetland ecosystems and species (**Targets 14 and 12**). For instance, constructing an artificial wetland to dispose of so-called 'produced water' from oilfields, as in the case study below, has many other environmental benefits.

Sustainable forest management **(Target 7)** will contribute to stopping forest loss (**Target 5**) and help conserve the genetic diversity of wild crop species (**Target 13**). This will further contribute to habitat and species conservation (**Targets 11 and 12**) and larger, more mature forests will capture carbon (**Target 15**).

Target 9 (alien invasive species) contributes to meeting **Target 5** (habitat loss), is particularly important for **Target 12** (preventing extinction of threatened species) and is one of the main actions required for **Target 14** (ecosystem restoration). It may also be important for **Target 10** (coral reefs and sensitive ecosystems)

In less developed regions, strengthening community-based management regimes to safeguard essential ecosystem services at local level **(Target 14**) is likely to contribute to sustainable production and consumption (**Target 4**), sustainable agriculture, forestry and aquaculture (**Target 7**), to the development of fair practices for fair and equitable sharing of benefits (**Target 16**) and preservation of traditional knowledge (**Target 18**).

Investments in **Targets 17 to 20** (implementing NBSAPs, using traditional knowledge, improving overall knowledge and technology, mobilising financial resources) will contribute to all of the preceding Targets.

Venter *et al*. (2014) discuss interdependencies between Target 11 (Protected Areas) and Target 12 (Species conservation) and suggest thatconsiderable increases in protected area coverage of species could be achieved at minimal additional cost by more systematically linking these Targets (Box 47).

Box 48 demonstrates that well-planned investments can deliver multiple benefits, and simultaneously contribute to a wide range of Aichi Targets.

While sequencing and prioritisation can help to enhance cost-effectiveness, given the urgency and the potential time lags, it may be necessary for work to begin at once on all the Targets, with opportunities taken to capitalise on synergies along the way. Prioritising and sequencing investments will need to be flexible to take into account national circumstances. However, it is possible to suggest a set of investments which, made early, are likely to have particularly high returns.

Investment in enabling targets that support action in pursuit of other targets will lower the cost of achieving the Targets overall

Evidence reviewed strongly supports the importance of a set of essential enabling conditions. Achieving

Box 47 Targeting global protected Area expansion (Target 11) for imperilled biodiversity (Target 12)

A study by Venter *et al*. (2014) used data on the distribution of protected areas and threatened terrestrial birds, mammals, and amphibians to assess current and possible future coverage of these species under the Convention. Governments have agreed to expand the global protected area network from 13% to 17% of the world's land surface by 2020 (Aichi target 11) and to prevent the further loss of known threatened species (Aichi target 12).

These targets are interdependent, as protected areas can help to conserve species when strategically located and effectively managed. However, this study reported that the global protected area estate is currently biased toward locations that are cheap to protect and away from important areas for biodiversity.

This study found that 17% of the 4,118 threatened vertebrates are not found in a single protected area and that fully 85% are not adequately covered (i.e. to a level consistent with their likely persistence). Using systematic conservation planning, it showedthat expanding protected areas to reach 17% coverage by protecting the cheapest land, even if ecoregion allyrepresentative, would increase the number of threatened vertebrates covered by only 6%. However, the nonlinear relationship between the cost of acquiring land and species coverage means that fivefold more threatened vertebrates could be adequately covered for only 1.5 times the cost of the cheapest solution, if cost efficiency and threatened vertebrates are both incorporated into protected area decision making. These results are robust to known errors in the vertebrate range maps. The Aichi Targets may stimulate major expansion of the global protected area estate. If this expansion is to securea future for imperilled species, it was found that new protected areas must be sited more strategically than is presently the case.

Box 48 Multiple benefits from the Nimr Water Treatment Plant, Al-Nimr oilfield, Oman

Investments in wetlands for the treatment of wastewater in Oman provide multiple benefits, and can help to deliver Aichi Targets 8 (pollution), 12 (species protection), 14 (ecosystem restoration) and 19 (biodiversity knowledge).

Extracting oil reserves on land often produces large quantities of "produced water", wastewater which remains after the crude oil has been separated from the water that contains it. Produced water is typically disposed of by pumping it into deep (2 km) aquifers ("deep well disposal"). This method of wastewater disposal poses a risk to underground water reserves and is becoming less acceptable.

Petroleum Development Oman (PDO) entered into an agreement with BAUER Nimr LLC to design, construct and operate an artificial wetland to treat part of the produced water of the Al-Nimr oilfield. The wetland became operational in 2010. After a first oil-water separation process, the wastewater flows into a 350 hectare wetland where organisms living on the roots and stems of the plants break down the hydrocarbons and other contaminants. The water then flows into evaporation ponds and disappears. At its current size the site can process 95,000 cubic meters of produced water per day, a sizeable share of the daily volume of water produced by the Al-Nimr oilfield. For PDO, this natural approach to cleaning up its wastewater has several benefits. First, the wetland requires much less energy (< 2%) and maintenance than the pumps needed for deep well disposal. Thus, the carbon footprint of the oil production process has been reduced significantly. Although the wetland requires an upfront investment, in the long run the reduction in energy costs and reduced maintenance is sufficient to offset the investment.

The Al-Nimr wetland also delivers environmental benefits, and has quickly become a refuge for over 100 bird species, including the endangered Egyptian Vulture and near-threatened Bar-tailed Godwit, and, in an otherwise arid region, is a stop-over for many migrants between southern Africa and north Asia. It supports a wide range of plant species, and presents a more diverse landscape mosaic than conventional reed-bed installations. It provides training opportunities for Omani researchers from the new National Field Research Centre for Environmental Conservation (NFRCEC).

The Al-Nimr wetland also received and treats sewage, which supports plant growth and avoids damage to the vulnerable desert ecosystem. Having passed through the wetland, the water is saline but has undetectable levels of hydrocarbons and trace elements. This has prompted research into the potential re-use of the water in an area characterized by water deficits. Research has also identified plant species with agricultural potential that can cope with the salinity of the water, including *Salicornia* and *Jatropha* (for biodiesel), several species of *Acacia* (for firewood and charcoal) and *Mangrove* (for restoration initiatives). This research is in its initial stages, but could yield a range of benefits to Oman and other oil producing countries by reducing water deficits, reducing pollution impacts, promoting sustainable agriculture and providing employment opportunities.

Sources: Muscat Daily (2013); Headley and Lisker (2013); Headley, pers. comm. (2013)

Targets 1-4 (Strategic Goal A) and Targets 1-4 and 16-20 (strategic goal E) should reduce the costs for reaching other Targets. Actions under these Targets such as increasing public awareness and political will (Target 1) and the science base (Target 19) will create the foundations for being able to effectively deliver the targets on conservation, species protection and ecosystem restoration (e.g. Targets 5, 8, 12 and 14). This also includes appropriate policies that discourage practices harmful to conservation of biodiversity and incentivise those involved in conservation (Target 3).

The evidence shows that investments in these Targets will be important across the world However, they are of even higher priority in many less developed regions, where appropriate frameworks and institutions have yet to be established. Without these conditions, many of the other actions to support the other Targets are unlikely to be effective.

Many of the actions undertaken in Strategic Goals A and E may take substantial time to influence biodiversity status. In this context, Targets 17 (knowledge generation) and 20 (resource mobilization) are particularly important as they provide the resources and tools required in the initial stages of implementation of the Strategic Plan (CBD 2014)

Cost effectiveness can be enhanced through investment in preparatory actions and good planning, but may be reduced by delaying action

Regional evidence highlights a number of cases where resource needs could be reduced through careful planning, and the importance of investing time in preparatory actions. In Europe, it was found that upfront planning through studies or well-informed strategies can greatly reduce the costs of later practical (i.e. restoration, conservation) measures, and where they are relatively cheap in comparison to practical measures, will increase the cost effectiveness of next steps (Tucker *et al*. 2013). Two case studies (Box 49) show the importance of developing the knowledge base. In the US, it was noted that investments in improving the knowledge, science base and technologies (Target 19) and the development and dissemination of decision support tools for biodiversity conservation would improve the cost effectiveness of all other investments.

Evidence shows that spending time on research will inform strategy and thereby increase cost-effectiveness of the next steps, but there are also trade-offs between the knowledge gained and the costs of delaying actions, and these trade-offs can be reduced if adaptive management is possible.

Box 49 The importance of investing in evidence in Serbia and the UK

The **Serbia** NBSAP states that a "well-functioning biodiversity information system is a prerequisite for achieving a good nature protection paradigm", and the generation of basic knowledge about biodiversity and conservation status through a biodiversity information system is "an essential step towards increased and more effective biodiversity conservation". Hence, the development of an information system is crucial to supporting and informing the biodiversity policy and decision making (Ministry of Environment and Spatial Planning of the Republic of Serbia, 2011).

Similarly, the **UK** NBSAP also assumes a good evidence base to be prerequisite for "delivering the strategy effectively". The authors state that such a base would "help us make sure we are doing the right thing in the right place, and using our resources effectively, focusing on action that will have the most impact" (Defra, 2011).

In other cases, for example the gazetting of new protected areas, there may be less opportunity for adaptive management. The planning of these areas needs to be done carefully in order to meet targets and maximise their success, and will involve time consuming stakeholder processes. Nevertheless, the expansion of protected area systems is urgent given pressures on land and marine systems, and planning efforts should not delay implementation longer than necessary.

Meeting the Targets depends on effective institutional frameworks as well as adequate resources

Barriers to meeting the Targets may have as much to do with a lack of the appropriate institutional frameworks and decision making processes as with a lack of resources. Effective action will require coherent policies, improved institutions and strengthened governance, engaging all relevant actors from global to local level.

Whilst it is clear that there is a significant shortfall in the availability of resources required to meet the Aichi Targets, weak governance, policies and institutions, silos and a lack of political will are also significant barriers to progress. Though this may be particularly the case in least developed regions, these barriers exist in all regions of the world.

Institutions mandated with biodiversity management are often weak, lacking in capacity, limited in data and indicators or exclude key stakeholders, thus limiting their effectiveness. At the same time, institutions geared towards 'higher priority' goals (e.g. economic development) often omit to consider biodiversity (Emerton 2000). Biodiversity is poorly integrated into broader policies, and programmes and the underlying causes of biodiversity loss have not been addressed (GBO3). Even where biodiversity policies are good, they are often ineffective due to weak or ineffective law enforcement; or hampered by contradictory policies counteracting the benefits of investments made. These barriers significantly exacerbate resource constraints through less inclination and limited means (e.g. through coherent policy or budgeting) to dedicate resources to biodiversity conservation. Where biodiversity is not a political priority and not integrated into macroeconomic policy, funding cannot be obtained from either governments or from international donors. There is a need for an integrated strategy whereby macroeconomic policies and the social sector and development priorities are linked to national implementation strategies for implementing the Convention on Biological Diversity (Damodaran, 2012).

Box 50 Gaborone Declaration: political wisdom for Sustainability

The Government of Botswana announced on 25 May 2012 the endorsement of the Gaborone Declaration by ten African countries and numerous public and private sector partners from within and outside Africa. The Declaration, a set of concrete principles and development goals that move the value of natural capital to the centre of development planning, was the culmination of discussions held over the two-day Summit for Sustainability in Africa. Among the agreements were two key conclusions: that the historical pattern of natural resources exploitation has failed to promote sustained growth, environmental integrity and improved social capital and has, even worse, been counter-productive; second, that the value of natural capital, or the wealth of benefits and services provided to people by biodiversity and ecosystems such as watersheds, forests, coral reefs and grasslands, must be fully accounted and integrated into national and corporate planning and reporting practices, policies and programmes.

The Gaborone Declaration also reaffirmed African nations' commitments to implement all existing conventions and declarations that promote sustainable development and committed the ten countries present to annual reporting on their natural capital accounting efforts. The President of the Republic of Botswana, Khama Ian Chama, in his closing remarks said *'This meeting for ''Sustainability in Africa Summit" is for us on this continent and as Leaders to reaffirm our commitment to sustainable development. This shall be evident in addressing developmental challenges and in recognition of the significant role played by the natural resources capital. Currently the contribution of natural resources in development is not well accounted for. The value of natural resources in sustainable development and livelihoods should be clearly incorporated as an asset for development'*

Investments in institutions will be essential for delivery of the Aichi Targets and for mobilisation of funding. In the broadest sense, this will involve changing policies, practices and rules to enable biodiversity conservation and capacity building to ensure that investments achieve their intended outcome (Targets 16,17 and 20) Coupled with this should be investment in improved information on biodiversity and its values and awareness raising of decision makers and delivery bodies across sectors (Targets 1,2 19).

The governance of biodiversity is a complex system, involving multiple actors (governments, corporations, NGOs and individuals) from the global to the local levels and all these need to be recognised, engaged and incentivised for the achievement of the Aichi Targets. Regional co-operation has been shown to be essential in delivery of biodiversity objectives and can also help to enhance synergies across policy agendas and parallel initiatives. In South Asia, the Hindu Kush, Himalayas is a trans-boundary ecosystem and initiatives have been developed to identify and utilize synergies for joint delivery in conservation of biodiversity in this ecosystem across both programmes and countries (Box 51). Such joint programmes are imperative to address trans-boundary factors influencing biodiversity.

In many countries, a strong focus on engaging local communities and community based management is essential for conservation success, cost effective use of resources, and the provision of development opportunities. This may depend on putting in place, or strengthening, a legal framework for supporting community rights to manage resources, building capacity of both governments and communities, and strengthening local organizations. For example, there may be a need for legislation to protect recognised traditional fishing grounds, or the integration of management plans and protected area programs with community participation activities.

Box 51 Regional cooperation in the Hindu Kush, Himalayas

The International Centre for Integrated Mountain Development (ICIMOD) is a regional intergovernmental learning and knowledge sharing centre, based in Kathmandu, Nepal serving the eight regional member countries of the Hindu Kush Himalayas - India, Pakistan, Bhutan, Bangladesh, Nepal, Afghanistan, Myanmar and China. Among the large number of initiatives undertaken by ICIMOD, many are specifically based on relevant Aichi Targets. Information on some of these initiatives is given below.

ICIMOD Initiative	Relevant Aichi Target	Implemented in
Hindu Kush Himalaya Biodiversity Information Facility	Target 19	All member countries
High Altitude Wetlands Initiative	Targets 11, 12, 14 and 15	All member countries
Innovative Policy and Development Options for Improving Shifting Cultivation in the Eastern Himalayas	Targets 5, 7, 13, 14and 15	All member countries
Strengthening Upstream-Downstream Linkages	Targets 1, 2, 3, 4, 5, 14 and 15	All member countries
Improving Livelihoods through Knowledge Partnerships and Value Chains of Bee Products and Services in the Himalayas	Targets 3, 4, 14 and 15	Bhutan, India and Nepal
Himalayan Climate Change Adaptation Programme	Targets 14 and 15	All member countries
Assessment of ecosystem services and livelihoods of the people	Targets 14 and 15	Bhutan and Nepal
Kailas Sacred Landscape Conservation	Targets 1, 2, 11, 14, 15, 18 and 19	China, India and Nepal
Gender mainstreaming in rangeland resources management	Targets 2, 3, 4, 5, 14 and 15	China, Nepal and Bhutan

Box 52 The need to invest in communities and community based management

In **Mozambique**, communities surveyed in MPA areas all agreed that marine resources were declining and that something needed to be done, but did not support MPAs as an appropriate measure to address the problem. The local communities felt that fishing by outside fishers, industrial and semi-industrial fishing, and poor law enforcement by government authorities were to blame, and that they themselves should not have to be excluded from these areas. They were not interested in proposed generation of alternative income-generating activities. Views were expressed that, where parks are based primarily on conservation targets and promotion of tourism, they are unlikely to alleviate poverty, and may also have limited success in conserving biodiversity as a result. The implication is that parks should be established with local communities, rather than being imposed on them (Rosendo *et al.* 2011).

Locally Managed Marine Areas (LMMA) activities in **Madagascar** have centred on managing key species (octopus) and demonstrating management effects to local communities. For example, temporary closures of octopus fishing areas have increased catches and demonstrated the benefit of this fishery management technique. Preliminary results indicate that the closures increase individual weight per unit effort (Oliver *et al.* in prep) and increase income (Olson *et al.* in prep.). Thus the perception amongst villagers is nearly uniformly positive regarding the closures (Olson *et al.* in prep.). This management technique has thus been replicated hundreds of times along the coast north of Toiler, South West Madagascar. Community awareness of the ecosystem services flowing from the LMMA has increased through the participatory management process over the past 7 years. Aside from community meetings surrounding resource management, the LMMA integrates community members in extensive environmental educational campaigns, scientific research, and community-based monitoring. The evidence suggests that in cases where the resources for enforcement are lacking, management regimes that are designed to meet community goals can achieve greater compliance and subsequent conservation success than regimes designed primarily for biodiversity conservation.

The Mingo Conservation Project in **Tanzania** obtained the first FSC certificate for community-managed natural forest in Africa. The certification resulted in increased revenues of US$1,800 for the two communities involved, half of which was used to pay forest patrols and management activities (creating jobs and boosting the local economy) and the other half to build new houses (Oldfield 2012). It is anticipated that FSC certification will enable communities to earn more than US$19 per log compared to US$0.08 they received before the start of the Project (Oldfield 2012). Communities with more than 7,000 hectares of forest are expected to earn more than US$100,000 per year from this scheme (Ball, 2010).

In all regions, improvements in participatory processes, particularly those recognising citizens' rights to benefit from biodiversity and to shape policy, planning and management, would help to deliver the Aichi Targets.

4.8 Key Message 8:

Design and implementation of appropriate economic and policy instruments is essential to halt the loss of biodiversity.

Achieving the Aichi Targets at least cost will require more efficient use of public budgets, together with the application of a wider range of economic instruments and incentives.

Much can be gained by phasing-out perverse incentives and unsustainable practices, and extending good land use and marine planning and the development of green fiscal policies.

Greater understanding and acceptance of the benefits of biodiversity action will encourage policy decisions that support resource mobilization and promoteeconomic efficiency, market access, income diversification, fiscal reform and private sector investment. This will also provide clear and consistent signals to consumers, producers, investors and decision makers.

More efficient use of existing public budgets is needed

The actions required to meet the Aichi Targets require major investments and, given the very real constraints, trade-offs and priorities will have to be made. Nevertheless, resources acquired through grants and government funding can and should be stretched using better financial strategies and augmented by including the private sector as far as possible, for example through optimal pricing, payments for ecosystem services (PES) programmes, REDD+ projects, volunteer programmes and Socially Responsible Investment.

Analysis above demonstrates that much can be achieved by mainstreaming biodiversity considerations into existing expenditure programmes for development, environmental protection and natural resource management. Furthermore, the regional research highlighted specific opportunities to increase biodiversity expenditures from existing programmes. For example, in Europe, many of the additional resources required to deliver the Aichi Targets could be provided through existing budgets. This is particularly the case for actions for sustainable agriculture, forestry and fisheries, which are heavily subsidised. However, other substantial public budgets for economic development, research and innovation also offer great scope for enhancing biodiversity finance through mainstreaming. In the EU, a range of funding instruments has been identified as sources of funds for Natura 2000, the EU's network of protected areas. In North America, similar opportunities were highlighted to reform existing subsidies and incentives for the benefit of biodiversity.

The removal of harmful subsidies is a high priority and could mobilise significant resources

The elimination of harmful and market-distorting subsidies, including those supporting agriculture, fisheries, forestry and the extractive industry would reduce negative impacts on biodiversity and free up resources that could be used for other investments in biodiversity protection and in more cost-effective development strategies. Proactive investments in sustainable production and consumption will be far less effective without either first, or at least simultaneously, eliminating subsidies to unsustainable production and consumption.

- At a global scale, it has been estimated that the removal of harmful fisheries subsidies, which currently amount to some US$19.2 billion, would result in a net gain in resource rent of US$125 billion ($78 – 171 billion) by 2020 (Harding *et al.* 2012).

- In North America, regional evidence highlights the importance of reforming subsidies and perverse incentives as a means to reduce rates of biodiversity loss and to free up resources for positive action. Eliminating the US$700 billion in inefficient or perverse subsidies would not only liberate enormous resources for conservation and other uses, but it would also reduce the negative pressures created by the subsidies themselves. Such an approach would make it possible to invest every year a sum on par with the U.S. government's financial bailout of 2008-2010.

The following box highlights examples of opportunities and challenges for subsidy reform in Europe and Africa.

Box 53 The importance of subsidy reform in Europe and Africa

CAP Reform in the EU

The CAP represents a policy that has included both "negative" (i.e. harmful to biodiversity) as well as "positive" incentives. Without doubt, the CAP has encouraged widespread agricultural intensification in the EU, with well-documented (negative) impacts on biodiversity since the 1970s. These have included a decline of the farmland bird index by 50% in the last 30 years or so, and significant decline of non-crop plants and invertebrates) (TEEB 2009a).

At the same time, a great number of rare and vulnerable species of EU importance are associated with semi-natural habitats and agricultural landscapes (such as High Nature Value farming systems). These - threatened by intensification/competition and abandonment - are also supported by CAP payments designed to support farming in disadvantaged areas or to support environmentally beneficial practices.

While successive reforms of the CAP have decoupled subsidies from production, and increased resources for rural development programmes and agri-environmental measures under the CAP's "second pillar", TEEB (2009a) expressed concern about the continuing magnitude of direct payments, because of limits to decoupling. Direct payments are still seen as a barrier to conservation, on the grounds that they inflate land prices and encourage land conversion. They have been shown to significantly increase the opportunity costs of peatland restoration in NE Germany (Förster 2009).

In the CAP negotiations for the period 2014-2020, a further "greening" of the CAP (especially Pillar 1 payments) was vehemently demanded by environmental and civil society NGOs, but the agreed reforms were not as ambitious as original EC proposals (Matthews 2012). Furthermore, provisions for flexibility in transferring 15% of funding between Pillars mean that realising benefits will be dependent on national implementation, and the alignment of national biodiversity and agricultural policies.

Sources: TEEB (2009a); Matthews (2012); EC (2013)

Biodiversity-harmful subsidies in Africa

In 2004 Ghana was forced to discontinue subsidising petroleum products. This has been shown to deliver environmental benefits as well as to improve social equity, since the price subsidies predominately favoured the better-off in society. The reform was supported by an information campaign explaining the need for fuel prices rises and announcing mitigation measures, and was broadly accepted by the public. Lessons learned are that subsidy reforms will be more effective if the public understands who is receiving the subsidy and how much; and compensation spending should be transparent, immediate and pro-poor (CBD 2011).

In Malawi, the Ministry of Agriculture and Food Security spends 85% of its budget, which amounts to about 10% of the national budget, on the Farm Input Subsidy Programme. This programme subsidizes improved inputs like hybrid (maize) seeds and fertilizers. The scale of the subsidy is reportedly hindering investment in other areas and there are also concerns over the impacts of the subsided fertilisers on local ecosystems. As yet there are no plans to tackle the issue of subsidy reform (UNDP-UNEP 2013).

In Botswana, agricultural input subsidies increase the exploitation of natural resources and sometimes lead to unsustainable use of natural resources. For instance, the loan schemes supporting purchase of livestock for keeping in communal lands that are already overgrazed around settlements tend to exacerbate the problems of overgrazing and diminish the productive potential of those rangelands. Following lack of grazing and desertification, the poor might tend to adopt desperate means of survival and begin to overharvest fuel wood and other products to sell as a means to earn an income, with a negative impact on biodiversity (Yaron *et al.* 2012).

The example of Costa Rica (Fig 4.3) demonstrates how the elimination of perverse incentives, and development of positive ones, through a national PES (PSA) programme, has helped to halt deforestation over a 20 year period.

Despite strong arguments in favour of reform, negative incentives persist on a large scale, since policy reform faces significant political and practical barriers. Further work to identify the barriers to subsidy reform, and to find ways of addressing them, will aid the reform process.

New incentives and financing mechanisms will help to deliver biodiversity targets

A recent report by the OECD highlights the opportunities to scale up biodiversity finance through the use and effective application of a range of financing mechanisms (Box 54).

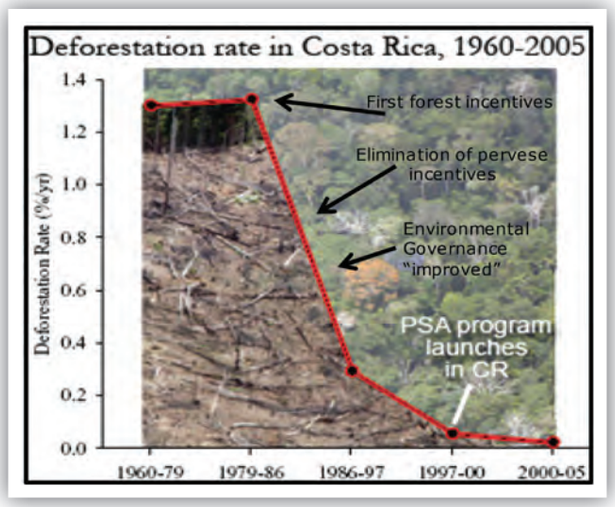


Figure 4.3: Incentives and Deforestation in Costa Rica

Box 54 OECD work on innovative finance for biodiversity

Recent work by the OECD (2013) highlights opportunities to scale up biodiversity finance through use of a range of financing mechanisms:

Environmental Fiscal Reform – environmentally related taxes were estimated to generate revenues of US$700 billion in OECD countries in 2010. However, revenues from taxes on pollution and resources – which are most relevant for biodiversity - constitute a very small fraction of this total and offer substantial growth potential.

Payments for Ecosystem Services – there are now more than 300 PES programmes around the world, and there is scope for considerable further growth. It is estimated that 5 national PES programmes alone involve payments exceeding US$6 billion per year. Another study estimates that payments for watershed services in 2008 totalled over US$9 billion.

Biodiversity offsets - 45 programmes require biodiversity offsets or compensatory conservation measures, and were estimated to have mobilised financial resources of between US$2.4-4 billion in 2011.

Markets for green products have developed for goods and services that are based on sustainable use of biodiversity and ecosystems. There has been growth in certified timber and seafood products and new markets are emerging in sustainable soy and sugar. Price premiums for green products reward practices that benefit ecosystems and biodiversity.

Biodiversity in Climate Change Funding – there is potential to leverage biodiversity co-benefits within the increasing flow of finance that is directed towards climate change mitigation and adaptation. Notable examples of where synergies can be harnessed include the mechanism for Reducing Emissions from Deforestation and Degradation and ecosystem-based adaptation. Climate change finance flows were estimated at US$70-120 billion annually in 2009/2010, with lower bound estimates of biodiversity related climate change finance from multilateral sources amounting to US$8 billion.

Biodiversity in International Development Finance– there are opportunities to harness synergies and better mainstream biodiversity in broader development objectives. Biodiversity-related bilateral Official Development Assistance (ODA), as tracked by the OECD Development Assistance Committee, increased from an average of US$3.3 billion per year in 2005/06 to US$5.7 billion per year in 2009/10.

The regional research reports highlight several cases where innovative funding sources could be used to meet some of the resource needs for delivering the Aichi Targets. For instance, aside from government spending and funds from international donors, user fees appear to be a potentially significant source of additional funding which can be reinvested into biodiversity conservation actions.

Waldron *et al.* (2013) reported that some countries in Latin America have developed the institutional capabilities to lever additional funds from beneficiaries of ecosystems services as well as ensuring a constant flow of resources from national expenditures. For example, Mexico and Costa Rica have set up tax systems to finance conservation activities (Box 54). User fees vary widely in their importance, with their share of biodiversity expenditures ranging from 9% in Mexico to 75% in Honduras. Honduras and Argentina receive approximately one third of their financial contributions for protected areas from revenues generated by user fees. There appear to be considerable opportunities for tapping into this resource further. The Caribbean, for instance, is strongly dependent on tourism, and there is further scope for the use of the revenues from tourism in conservation activities.

Box 55 Payments for Ecosystem Services in Costa Rica

Costa Rica has successfully increased resources for biodiversity conservation and ecosystem management through the development of Payments for Ecosystem Services, and by attracting finance from a range of sources.

Three Forest Laws enacted in 1977, 1986 and 1996 improved Costa Rica's capability to capture financial resources for forests. In 1996 law changed the justification for payments from support for the timber industry to the provision of environmental services (Pagiola, 2008). The creation of the ministry of the environment (Ministerio del Ambiente y Energie, MINAE) in 1986 and the National Fund for Forest Financing (Fondo Nacional de Financiamiento Forstal, FONAFIFO) in 1996 enabled the development of a national program for payments for environmental services. FONAFIFO was authorized to create trusts, to issue securities and bonds, to negotiate projects and to receive grants or credits (Saenz, 2008). Costa Rica benefited from grants provided by international donors such as the World Bank and the bilateral technical cooperation with USA (AID), and then with the Netherlands, Sweden and Finland under a SWAP agreement, supplemented by other donations (Ecomarkets and Mainstreaming Market Based Instruments for Environmental Management projects from GEF and the Huetar Norte Forest Program from German aid agency, KfW) (Pagiola 2008). These latter donations secured biodiversity conservation activities in protected areas or in areas of strategic concern for preserving biodiversity.

FONAFIFO also receives finance from the government budget, in particular through the collection of 3.5% of fuel tax revenues and 40% of timber tax. This latter flow of revenue has not been collected yet due to the challenges involved.

Costa Rica has made progress in securing financial resources over the long term by collecting payments for ecosystem services from beneficiaries of watershed conservation schemes, including hydropower, beverage and water utility companies. There is further potential to raise revenues from the tourism sector for the provision of landscape, recreation and ecotourism benefits. However, potential buyers are scattered and diverse, and no contract has yet been signed, despite the country being one of the finest destinations in Central America for its landscape and biodiversity.

Regarding mitigation of CO_2 emissions, Costa Rica was able to sell carbon emission credits through the provision of Certifiable Tradable Offsets (CTOs) which represent an externally certified 1-tonne net reduction in carbon emissions. The first impetus was given by the payment of US$2 million for 200,000 CTOs from the Norwegian Government and a consortium of Norwegian power producers. Costa Rica obtained a contract through the World Bank's Bio Carbon Fund that enables the country to negotiate sales of about 0.61 million tonnes of carbon dioxide equivalent (tCO_2e) by 2017 for activities related to planting trees in agroforestry systems, natural regeneration and commercial plantations (Pagiola, 2008).

Payments for ecosystem services will play an important role in meeting Target 3 (biodiversity incentives) and in supporting the delivery of other targets, particularly those related to reducing habitat loss (Target 5), sustainable land management (Target 7) and ecosystem restoration (Targets 14-15). Global data on support for the development of PES and related positive incentive schemes funded by the GEF suggest an average cost of approximately US$40 million per project, at current prices, including co-funding.

Japan has used economic valuation studies to enhance understanding of the value of ecosystem services, and to inform the development of positive incentive measures for agriculture and forests (Box 56).

Box 56 Paying for the ecosystem services delivered by forests in Japan

Japan's forests provide important ecosystem services, which include CO_2 absorption, erosion and landslide prevention, flood mitigation, provision of freshwater, water purification, recreation and amenity. The value of these services was estimated at 70,264 billion yen (US$694 billion) in 2001. Replacement cost methods have been used since 1972 as a means of valuing these services. The valuation results have helped to inform various forest conservation measures and activities, including the designation of conservation forest, protected forest and forest ecosystem reserves, and a program of direct payments. "Conservation forest" is particularly important for providing public benefits, such as securing water resource and preventing disasters. The total area of conservation forest is 48% of total forest area and 32% of Japan's total land area.

A Forest Conservation Tax has been developed as a local environmental tax which funds Payments for Ecosystem Services (PES), based on the Beneficiaries Pay Principle, in order to raise funds to secure water supplies and other benefits. The tax is operated by a prefecture government, and applied in 30 of Japan's 47 prefectures. The Kochi Prefecture implemented the tax in 2002, imposing it at a level of 500 yen/taxpayer. It has helped to improve management of abandoned afforested areas where ecosystem services were being lost, and to improve water supplies, at a time of budgetary constraint of the prefecture government. The tax rate was informed by a willingness-to-pay survey. In 2008, total amount of tax collected was 4 billion yen (US$40 million).

Source: Yoshida (2011)

In the context of India, Damodaran (2009) proposes issue of 'Tiger Bonds' to enhance conservation measures for tigers in protected area habitats. Such debt based instruments are not only economically feasible but also serve to enhance resource flows to tiger habitats. More importantly they create greater accountability on the part of the national park authorities to achieving conservation targets.

Box 57 illustrates the need for incentive mechanisms that address the needs of communities affected by biodiversity conservation.

In addition, there is also scope for increasing funding from private sources through the introduction of conservation fees. For example, with regard to the resource crunch to implement programmes for biodiversity conservation in Maldives, a recent study estimates that over US$18 million can be generated annually from such conservation fees, which is more than two-and-half times the current annual budg*et al*location and has a potential to fill in part of the funding gap.

Sustainable and predictable finance is essential for the long-term effectiveness of Protected Areas (PAs). Traditionally, PAs have been funded through government budgetary allocations, bilateral and

Box 57 Buxa Tiger Reserve, India – the role of incentive-based mechanisms to balance the distribution of benefits from biodiversity conservation

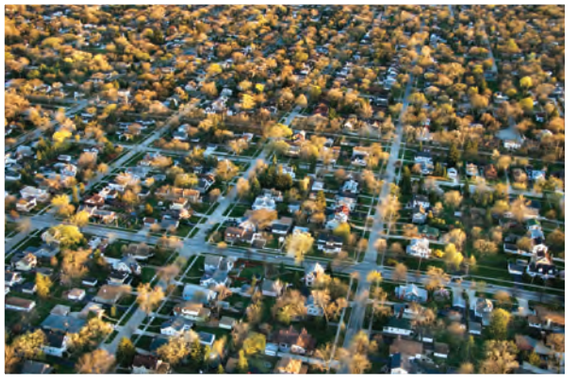
In India, as elsewhere, protected areas (PAs) have permanent resident populations who are historically dependent on forest resources for their livelihood. The Buxa Tiger Reserve (BTR), in the northern part of West Bengal, is one such reserve forest where villagers have resided for more than 100 years. With the creation of a national park, employment opportunities for the forest villagers, who were once an important labour force for the commercial forestry regime, have drastically declined. To reduce pressure on forest resources at the BTR, the World Bank financed India Ecodevelopment Project (IEDP) was initiated with the aim to involve local people by supporting sustainable alternative income-generating activities. The project aimed to reduce cattle populations and stall feeding of cattle, regarded as having negative impacts on the reserve. A study assessing the viability of this strategy found that reduction or removal of cattle may not be a viable option, as it will adversely affect the livelihoods of vulnerable communities with few alternative employment opportunities. A more pragmatic approach of rotational grazing would help to conserve protected forest areas in countries like India. The findings highlight one of the basic problems associated with biodiversity conservation – that of mismatch between costs and benefits at various spatial scales. Often, biodiversity conservation leads to loss of access to natural resources on which local communities are highly dependent. Incentive-based mechanisms hold the key in such cases to balance the costs and benefits of meeting the Aichi Targets and influence decisions of resource managers.

Source: Das (2008)

multilateral agencies, and charities. In recent years, increased attention has been given to identifying innovative national and international financial mechanisms for PAs to supplement these traditional sources and diversify revenue streams for management. For example, UNDP has developed an evaluation framework to assist countries in the development of sustainable financing strategies for parks. Such strategies include revising park pricing strategies, enabling voluntary payments and donations, and setting up endowment funds. Box 58 gives two examples of the application of innovative financing systems for marine protected areas.

In the Amazon region of Brazil, an endowment fund has been established to raise finance from a range of public, private and NGO sources with the aim of addressing long term financial needs as assessed through a cost model (Box 59).

Another way of leveraging action for biodiversity conservation as part of other efforts is to use investors and fund managers to follow the Principles of Responsible Investment. Box 60 discusses Responsible Investment in Africa. Box 61 discusses action on biodiversity by signatories to the Principles for Sustainable Insurance (PSI).



However private and public investments that are sourced from debt based instruments like 'bonds' require the introduction of market based risk management instruments like 'options' that insulate bondholders from risk of default by bond issuing authorities (Damodaran, 2009).

Biodiversity offsets represent a growing source of private sector finance for biodiversity action. A report by Madsen *et al*. (2011) estimated that the annual global market for biodiversity offsets is now valued at between US$2.4-4 billion

Box 58 Innovative finance for Marine Protected Areas

Private Finance for Coral Reef Conservation in Sabah, Malaysia

The Sugud Islands Marine Conservation Area (SIMCA) is managed by Reef Guardian, a private not-for profit organization set up by the Lankayan Island Dive Resort (LIDR). The Sabah Wildlife Department awarded a 30-year concession to manage SIMCA for a fee of RM 60,000 (US$19,000) per year. The activities of Reef Guardian are significantly funded through the conservation fee of RM20/tourist/night (US$6.40) charged to all visitors to the resort. In addition, Reef Guardian receives RM35,000 (US$35,000) annually from LIDR for sub-leasing the three main islands in SIMCA, as well as a range of conservation grants. The overall management of SIMCA is estimated to cost around RM500,000 (US$158,800) annually. Reef Guardian staff are trained and certified by SWD as Honorary Wildlife Wardens, responsible for monitoring and enforcing regulations and promoting best practices for marine and environmental conservation. Investments in monitoring, enforcement and outreach have led to a decline of illegal fishing and turtle poaching, and an increase in fish and turtle numbers (Teh *et al*. 2008).

Sustainable Finance for the Phoenix Islands Protected Area, Kiribati

The Phoenix Islands Protected Area (PIPA), Kiribati was established to be self-sustaining and self-financing. The aim is to capitalize an endowment trust fund at a level that will generate an income stream sufficient to cover the operating and management costs of the trust, and the foregone revenues from fishing associated with the closure or restriction of activities within the PIPA region in Kiribati. The funding target is US$25 million, with an interim target of US$13.5 million by 2014, based on 25% of the PIPA area under no-take-zone area. The MPA receives the support of the "PAS: Phoenix Islands Protected Area (PIPA)" project (GEF: US$870,200, co-finance: US$1.7 million) implemented by UNEP (Gobin, 2012).

Box 59 Financing the Amazon Region Protected Areas Program, Brazil

The ARPA (Amazon Region Protected Areas Program) was created with the goal of expanding and strengthening the Brazilian National System of Protected Areas (SNUC) in the Amazon, through the protection of 60 million hectares, and ensuring financial resources for the management of those areas in the short and long run, while promoting sustainable development in that region.

According to the concern about the long-term financial sustainability of the Protected Areas supported by the ARPA Program, a cost model and a financial model were developed. The aim is to project the detailed costs for creation, consolidation and maintenance of Protected Areas; calculate the overall needs of fundraising; and ensure the basis for advocacy and planning for a gradual increase in the amount of public resources to the management of Protected Areas, replacing donor funding, in a 25 year period.

The models allow the identification of the Program financing gap, as well as assist in planning, funding and allocation of resources related to ARPA Program goals. According to Geluda *et al.* (2012) the estimated resource requirements of the Program for the period 2011-2020 would be R$799 million (US$352 million), while the estimated revenue would be R$530 million (US$233 million), resulting in a funding gap of R$269 million (US$118 million) for the period.

The program goals are related to Aichi Targets 5, 11 and 20, and demonstrate the mobilization of financial resources through private sector involvement related to the establishment and management of protected areas.

These models were key in the search of solutions to assure long term sustainability for ARPA. After a long design and discussion phase, through collaboration between the Brazilian government, NGOs, and public and private funders, an innovative financial model was created in May 2014 to finance the management and monitoring of ARPA protected areas in perpetuity.

The ARPA for Life financial model is based on a US$215 million "transition fund". It will be disbursed gradually in a period around 25 years, decreasing from high values to zero. Meanwhile, the Brazilian government will increase its own funding for ARPA each year, until it will be able to assume full responsibility for funding the ARPA protected areas in perpetuity.

Source: http://d3nehc6yl9qzo4.cloudfront.net/downloads/quanto_custa_o_programa_arpa.pdf
http://www.mma.gov.br/informma/item/10142-governo-garante-r$-444-milhões-para-preservação-da-amazônia

Box 60 Responsible investment in Africa

Responsible investment (RI) actively takes environmental, social and governance issues into account in investment decisions, with a view to driving the demand for sustainability in corporate decision-making. For example, the Nigerian banking sector has developed a set of Nigerian Sustainable Banking Principles under the stewardship of the Central Bank. All banks are now required to manage and mitigate the environmental and social risks associated with their activities and operations. In South Africa, mandatory disclosure of sustainability information is required for stock exchange listing, in compliance with the King Code on Corporate Governance (UNEP 2011). However, a survey of investors in South Africa showed that while they appreciate the need for these considerations, knowledge gaps and lack of evidence hamper progress. Principal officers of pension funds generally concurred that the most important barriers were related to the belief that RI necessarily meant lower financial return. Asset managers and advisors generally suggested that their most important barrier was a lack of demand from customers (institutional and retail). Respondents indicated that more stringent legislation would drive further participation. However, this could be avoided by increasing demand through investments in public awareness. It is arguably in the African continent, where acute environmental, social and governance pressures exist, that the benefits of responsible investment could have most impact (UNEP 2013).

Box 61 Principles of Sustainable Insurance

Developed by the UNEP Finance Initiative, and launched at the UN Conference on Sustainable Development (Rio+20), the Principles of Sustainable Insurance (PSI) are a framework for the global insurance industry to address environmental, social and governance risks and opportunities. It has become the largest collaborative initiative between the UN and the insurance industry dealing with sustainable development. Signatories commit themselves to include the environment into their decisions making on investments; to raise the awareness for environmental issues and to manage risks; to promote actions on the environment together with other stakeholders and policy makers; and to publicly disclose their progress.

A review of actions taken by insurance companies (reported through disclosed reports on the PSI web page) in response to fulfil their commitments under the PSI showed that there is a level of awareness of the importance of biodiversity, though specific activities are at an early stage of development. Positive examples of actions taken to address impacts on biodiversity and ecosystem services include:

- the promotion of biodiversity in business operations, and engaging with partners to support their efforts towards sustainable practices
- the establishment of a company strategy at the Board and executive management levels to identify, assess, manage and monitor sustainable use of natural resources
- the creation of insurance models incentivising sustainable practices, such as granting reductions in premiums to companies achieving environmental certification
- exclusions policies- for example, of investments that would result in deforestation of tropical rainforest

The insurance industry plays a substantial role within the financial sector and has the potential to reduce negative impacts on biodiversity and to contribute to the conservation and sustainable use of biodiversity in a number of ways, including through building on the above efforts and new opportunities such as the development of long term environmental risk modelling taking biodiversity, climate change and ecosystems into account. Other options include pricing that reduces the incentive for highly damaging practices (e.g. unsustainable mining or forestry) and incentivises biodiversity protection and damage mitigation.

The main obstacles to achieve sustainability and conservation of biodiversity in the insurance sector are short-term financial concerns, the absence of a platform to share information and best practices and the "uninsurability" of certain natural systems (RSA and WWF 2014). Moving this forward would require enhanced collaboration across the industry as well as with policy makers and with the conservation community.

Source: S. Reitmann, personal communication

annually, and is growing rapidly. Offsets aim to compensate for adverse impacts and to achieve no net loss or net gains in biodiversity. They have an important role to play in reducing ecosystem degradation (Target 5) and in funding restoration actions (Targets 14, 15).

International donor funding is also important. Some countries are almost wholly dependent on international funding mechanisms. These include Nicaragua, El Salvador, Bolivia, Panama and Peru.

The report for Asia does highlight one issue of note with regard to international funding; countries with high per capita incomes (e.g. West Asian countries), often do not qualify for funding from international donors. In the absence of national funding, implementing conservation efforts or even conducting research becomes difficult. Consequently progress on the Targets is quite possibly more at risk in richer countries than in poorer ones. This situation needs to be addressed by either national governments, international donors or both.

Box 62 gives the example of the Critical Ecosystem Partnership Fund, a global mechanism to mobilise resources from international donors to civil society action in biodiversity hotspots.

Box 62 The Critical Ecosystem Partnership Fund – A global mechanism to mobilize resources to civil society in biodiversity hotspots

The Critical Ecosystem Partnership Fund (CEPF) was created in 2000 to support the conservation of biodiversity within the global hotspots by engaging and strengthening the capacity of civil society. A first phase, which lasted until 2007, saw the establishment of the Fund and the growth of the partnership from the three founding donors — Conservation International (CI), the World Bank and the Global Environment Facility (GEF) — to five, with the John D. and Catherine T. MacArthur Foundation and the Government of Japan joining in 2001 and 2002 respectively.

As of 2013, CEPF has granted more than US$163 million in 23 hotspots in more than 60 countries and territories reaching out to over 1800 grantees and influencing the management of over 30 million hectares of key biodiversity areas – thus exceeding the targets set for Phase II. The partnership has also grown to seven donors, with the French Development Agency and the European Union joining in 2007 and 2012 respectively. CEPF has become an established grant-making facility, fulfilling a unique niche at the global level targeting civil society to conserve biodiversity in hotspots around the world.

With less than 0.5% of the global ODA dedicated to biodiversity annually, CEPF grantees have made huge improvements in the health of critical ecosystems around the world. CEPF investments have resulted in more than 12 million hectares of new protected areas created, more than 7% of the total terrestrial protected areas globally between 2000 and 2010. CEPF grantees have influenced the management of more than 28 million hectares of productive landscapes impacting the conservation of 12% of the AZEs and securing over 1,200 million tons of carbon through forest conservation projects. The catalytic role of CEPF has been impressive both financially as well as politically CEPF's US$163 million have leveraged over US$330 million from multiple donors and through its grantees the partnership has influenced the creation of over 75 policies, plans and laws that have mainstreamed biodiversity conservation in development decision making.

CEPF is a successful model that has demonstrated to its seven donors the power of partnering to effectively mobilize resources to civil society in the most critical biodiversity areas of the world. CEPF is currently designing its third phase in a way that it can scale up its success while maintaining its cost-effectiveness, empowering civil society to maintain the health of critical ecosystems that provide unique and irreplaceable services to close to 2 billion people around the world.

Given local variations in biodiversity financing needs and opportunity costs, financial instruments within government can also play an important role in helping to meet biodiversity targets. Box 63 presents the example of ecological fiscal transfers in Brazil.

Box 63 Ecological fiscal transfers – the case of ICMS-E in Brazil

Intergovernmental fiscal transfers are a central part of public finance worldwide, and in many countries represent a significant portion of the revenue of sub national governments. Only rarely, however, have environmental aspects been taken into account when defining those grants. So far, only Brazil and Portugal have adopted ecological fiscal transfers as a policy instrument, by adding ecological indicators into existing fiscal transfer schemes. In the case of Brazil, States have adopted this fiscal instrument as a compensation mechanism for municipalities, having protected areas as a major indicator (Ring, 2008). These arrangements, known as ICMS-Ecológico or ICMS-E, were independently established by 14 States in the early 1990s. Those States added ecological indicators into the revenue sharing mechanism of a State collected value-added-tax, the ICMS. In general terms, ICMS-E schemes compensate local governments for land-use restrictions associated with biodiversity conservation and the provision of ecosystem services (e.g. protected areas) by providing a larger share of the tax revenue to the impacted municipalities, acting as an incentive for conservation (Grieg-Gran, 2000; May *et al*. 2002). In Paraná, the first State to adopt ICMS-E, 5% of the municipal share of ICMS is allocated based on quantitative and qualitative assessment of biodiversity conservation areas and watershed protection areas; this represented about US$70 million in 2009 (Cassola, 2010). In the most recent development of the instrument, in 2013 the State of Pará, located in the Amazon region and heavily impacted by deforestation, established its ICMS-E scheme with a set original of indicators, including avoided deforestation and level of implementation of the Law of Native Vegetation Protection (previously called Forest Code).

4.9 Key Message 9:

The monetary and non-monetary benefits of biodiversity conservation and sustainable use frequently outweigh the costs.

Many studies have found that the benefits of biodiversity conservation and sustainable use can greatly exceed the investment costs. These studies cover all regions and a wide range of Aichi Targets.

Based on HLP (2012) annual aggregate estimates of investment needs, the global per capita investment needed for biodiversity action is estimated to be between approximately US$20 and US$60. This translates to investment requirements ranging from 0.2 to 0.5% of global GDP. Regional and country level evidence broadly supports the estimates of global resource needs made by the High-Level Panel in its first report. However, given the multiple benefits of the investments required, only a small proportion of these resources need to be found from dedicated biodiversity budgets.

HLP (2012) provided a first overall estimate of the level of resources required to deliver the Aichi targets globally, by aggregating global "top-down" estimates for each of the 20 targets. These estimates are presented in Annex Table A5. The estimates are inclusive of current levels of resources being allocated to the relevant activities.

Through simple addition of the resource requirements identified for each Target, the resources needed to implement the twenty Aichi Biodiversity Targets were estimated at between US$150 billion and US$440 billion per year. However, the report warned that these figures need to be treated with caution, and that these resource requirements should not and could not be met by biodiversity finance alone. Additionally,

synergies among the Targets mean that co-ordinated action could substantially reduce the total estimate.

Most investments will deliver multiple benefits and should not be financed through biodiversity budgets alone

- The Targets can be broadly grouped into three categories: **Biodiversity focused investments**. Some targets have a strong biodiversity focus and therefore require dedicated expenditures that are likely to come to a large extent from biodiversity budgets. These include investments in protected areas and species and genetic conservation, as well as biodiversity focused research, policy development, plans and awareness raising measures.
- **Investments in ecosystems and their services**. Some targets aim to conserve ecosystems and will deliver multiple benefits for climate, water, soils and other ecosystem services, as well as conserving biodiversity. These include targets to reduce ecosystem degradation and to achieve restoration.
- **Investments in economy wide programs to attain sustainability.** Other targets will deliver wider benefits for the sustainability of sectors (fisheries, forestry, agriculture, aquaculture), benefit human health and the wider environment by reducing pollution, as well as promoting the conservation and sustainable use of biodiversity.

Table 4.10 categorises the Targets and associated estimates of investments made in the HLP (2012) report into these three groups. It is estimated that expenditures focused directly and primarily on biodiversity make up only 18% of the total; a further 25% of investments will support climate action and other ecosystem services; while the majority of expenditures (an estimated 57% of the total) will support wider sustainability, through control of pollution and invasive alien species, and the promotion of sustainability in key sectors.

The implication is that a minority of the identified investments will need to come from dedicated biodiversity budgets, but most could be funded jointly through budgets for agriculture, forestry, fisheries, water, pollution control and climate action.

Regional Evidence

Very few quantitative assessments have been made at national or regional level of the resources needed to deliver biodiversity priorities. The regional reviews found few specific assessments of the resources needed to deliver the Aichi Targets.

However, a recent analysis for Ecuador by Conservation International (Albán *et al*, 2013) provided a target by target assessment of resource needs at the national level, and estimated that the resources needed to

Table 4.10 - Categorisation of Aichi Targets expenditures

Target		Estimated Annual Cost (2013–2020, US$bn)	% of total (midpoint)
Targets which require dedicated biodiversity expenditures	1 (Awareness raising); 2(Biodiversity values); 11 (Protected areas);12 (Species conservation); 13 (Genetic diversity); 16 (Nagoya Protocol);17 (NBSAPs); 18 (Traditional knowledge); 19 (Science base);20 (Mobilisation of financial resources)	14.9 - 93.7	18%
Targets which contribute jointly to biodiversity, climate action, water and other ecosystem services	3 (Incentives);5 (Reducing habitat loss); 10 (Coral reefs); 14 (Ecosystem restoration); 15 (Forest restoration)	49.6 – 96.4	25%
Targets which contribute jointly to biodiversity and wider sustainability	4 (Sustainable consumption & production);6 (Fisheries);7 (Sustainable Agriculture, Aquaculture and Forestry);8 (Pollution); 9 (Invasive alien species)	88.8 – 245.7	57%
Total		**153.3 – 435.8**	**100%**

deliver the Aichi Targets amount to US$670 million annually (Box 64).

To make an overall assessment, it is necessary to piece together often fragmented evidence of the costs of particular types of biodiversity action at different spatial scales.

Box 64 National Level Assessment of Funding Needs to Implement the Aichi Biodiversity Targets in Ecuador

A study by Conservation International for the CBD Secretariat assessed the resources needed to deliver the Aichi Targets in Ecuador.

The assessment examined financial needs for each of the Aichi Targets in turn. It produced a total estimate of US$4.6 billion for the resources required to deliver the 20 Targets nationally, equivalent to US$669.8 million per year over 7 years.

The largest components of this cost were estimated to relate to Target 4 on sustainable consumption and production (28%) and to Target 15 related to the cost of restoring degraded ecosystems (28%), followed by Target 8, reduction of pollution (10%).

Target	Resource needs (US$m)	Target	Resource needs (US$m)
1	33	11	527
2	72	12	7
3	246	13	109
4	1,296	14	49
5	45	15	1,332
6	19	16	3
7	128	17	1
8	453	18	8
9	44	19	311
10	1	20	6
		Total	**4,669**

This amount represents 19% of the Ecuadorian national government budget for the year 2013. The current budget for the entire environment sector of the Government for the year 2012 is US$163.4 million and the Ministry for the Environment (MAE) budget for year 2013 is US$110.6 million. This indicates the need to mobilise resources in addition to the national environment budget in order to achieve the Targets.

The best evidence on resource needs for most of the regions relates to the costs of establishing and maintaining protected areas, which are put at up to US$38 billion per year globally. Similarly, global and regional studies indicate that addressing deforestation (Aichi Target 5) through REDD+ will require investments of tens of billions of dollars annually. There is much less evidence on many of the other activities related to the other Targets.

The largest amount of evidence, related to the widest number of activities, was identified for the European region (Table 4.12). The figures suggest that the

Table 4.12 Estimates of resource needs for various activities in the EU

	US$bn per year	Euro (€) bn per year
Delivering the EU's environmental objectives using incentive based measures related to agriculture and forestry (Aichi Targets 3, 5, 7, 8, 10, 11-15 and 20)	60	43
Delivering ten biodiversity policy areas (Aichi Targets 5, 7, 9-12, 14, 15)	15.2	10.6
Full implementation of the EU Biodiversity Target (corresponding to Aichi Targets 8, 10-14 and 15)	0.8 – 2.2	0.6 – 1.7
Maintenance, restoration and re-creation requirements on arable land, grassland and permanent crops	40.7	29.2
Full implementation of the protected area network (Natura 2000)	8.2	6
Measures related to the Water Framework Directive	10.9 – 20.5	8 – 15
Addressing soil organic matter decline	4.7 – 7.8	3.4 – 5.6
Maintaining high nature value farmland	Up to 32	Up to 23
Addressing invasive alien species	0.06 – 0.27	0.04 – 0.19

Source: Various, see regional report for Europe

resources needed to deliver EU biodiversity targets – which have many common elements with the Aichi targets - would be in the order of tens of billions US$per year. The most expensive actions, as far as the evidence suggests, are land management and restoration measures related to farmed and forested land (Aichi Targets 7, 11-15). Many of the required resources could be secured through the application of existing EU funds to biodiversity actions.

The regional research found numerous country specific examples of resource needs for different activities. For example, Box 65 considers the example of the eradication of invasive alien vertebrate species from small islands in Australasia.

At the global scale, a number of studies have assessed the overall resources required to reduce rates of deforestation through REDD+ (Box 66).

Box 65 Resources required to eradicate invasive alien vertebrates from small islands in Australasia

Eradication of invasive alien vertebrates (IAV) from islands in Australasia has proven an effective conservation tool, resulting in recoveries of endangered species and threatened island ecosystems. Over 1,100 successful IAV eradications have been implemented on islands worldwide.

Island Conservation has developed a costing model for the eradication of invasive alien invertebrates based on the costs incurred in planning and implementing 37 successful vertebrate eradications on islands ranging in size from 6 hectares to over 400,000 hectares. The categories of cost included are: implementation, planning, non-target mitigation, additional costs associated with human inhabited islands, and isolation. This costing model has then been used in combination with island specific data to estimate the costs of eradication of IAV on 496 islands, representing 38% of islands holding critically endangered or endangered species, and would provide protection for 19% of insular critically endangered or endangered species.

The estimated costs for selected countries in the Australasia and Pacific region are shown below. The costing model is designed to estimate costs across groups of eradication projects rather than provide specific costs for individual projects. It is recognised that there is simply too much variation in project costs between different islands depending on island specific contexts and characteristics and these can only be understood through detailed analysis at the project level.

Country	Number of threatened species	Number of Islands	Total area of islands (km^2)	Estimated total cost (US$m)
New Zealand	12	9	1,215	85
Australia	11	17	1,193	117
French Polynesia	11	19	513	84
Northern Mariana Islands	8	9	177	27
Fiji	4	16	291	42
Total	**46**	**70**	**3,389**	**355**

Box 66 Global resources required to implement REDD+

A report of the Informal Working Group on Interim Finance for REDD+ (2009) estimated that a 25% reduction in annual global deforestation rates could be achieved by 2015 if financing of US$22-38 billion were made available from 2010-2015 for results-based incentives and capacity building, complementing other bilateral and multilateral REDD+ Efforts. By comparison, Eliasch (2008) estimated that the funds required to halve global emissions from the forest sector by 2030 could total US$17–33 billion per year, based on various models and taking account of both the opportunity costs of conservation and economic rents.

The costs of reducing emissions from deforestation and forest degradation include:

The opportunity costs of conserving forests, i.e. the foregone returns from alternative land uses;

The implementation and transactions costs involved in delivering REDD+, which include up-front capacity building measures and ongoing administration, management and monitoring.

Additional financial resources are required to cover the economic rents earned by the sellers of forest carbon credits, since in practice the price of credits will exceed the opportunity costs of many providers (Eliasch, 2008).

A recent review by White (undated) found that cost estimates range widely from US$4-184/ha/yr for implementation and administration and US$484-939/ha/yr for opportunity costs.

The Union of Concerned Scientists (2008) estimated the opportunity costs of REDD per ton CO_2 for a 46% overall reduction in global deforestation at between US$3.51 and US$12.26 at 2005 prices, with the lowest estimates based on regional assessments and the highest ones on global modelling.

Comparison with estimates in the HLP first assessment

The first HLP report found that there are clear differences in the relative scale of investment required to deliver the various Targets. In addition, the investment needed to deliver a Target is not necessarily correlated to its importance. Some Targets which require relatively little investment (particularly those under Strategic Goals A and E) are actually crucial in helping to deliver other Targets. Some may seem less resource-intensive, but could be more difficult to achieve, particularly if they require changes in institutions, policies, priorities, attitudes and behaviour. The scales of investment were broadly summarised as:

Significant investment required: For those Targets specifically aimed at addressing the drivers of biodiversity loss and ecosystem restoration, the required total global investment over the period 2013 to 2020 is in the order of several hundreds of billions of (US) dollars. Targets in this group fall under Strategic Goals B and D (excluding Target 16).

Moderate investment required: Targets associated with conservation work will require total global investment over the period 2013 to 2020 in the order of hundreds of billions of (US) dollars for Target 11 (i.e. establishing and maintaining protected areas) and in the order of tens of billions of (US) dollars, for the other Targets under Strategic Goal C.

Low investment required: Targets related to improving and creating necessary enabling conditions are likely to be much less resource-intensive. For these Targets, the total global investment needs over the period 2013 to 2020 will more likely be in the order of billions of (US) dollars. These Targets mostly relate to Strategic Goals A and E, as well as Target 16.

In general, the regional research reports support these findings, and the other key messages of the first phase of the HLP report with regard to resource requirements. Regional evidence demonstrates that restoration strategies as well as actions addressing the drivers of biodiversity loss are among the costliest of measures, and that the "enabling" strategies are less resource-intensive but still very challenging to deliver.

More specifically:

- The HLP (2012) estimates of resource needs for protected areas (Target 11) and reducing deforestation (Target 5) are within the ranges of other global estimates;
- A range of regional and national estimates relevant to various Aichi targets, while not always directly comparable, are consistent in size with the overall magnitude of estimates found by the HLP in its first report;
- The national estimate for Ecuador gave a total of US$670 million per year (Albán *et al*. 2013), which is equivalent to approximately US$2,363 per km^2 of national land area per year. This falls within the range of the estimates in HLP (2012) (US$1,027-2,925 per km^2 of global land area). However the balance of estimates by Target differs significantly in the Ecuador assessment compared to HLP (2012) – with relatively high estimates for Targets 2-4, 13 and 20 and relatively low estimates for Targets 5, 6, 9, 12 and 14. These differences are likely to reflect particular national conditions and priorities, as well as different assumptions and assessment methods;[71]
- There are numerous specific examples of the unit costs of conservation activities that are consistent with the unit costs used in the HLP first report;[72]

[71] The largest difference is for Target 4 (Sustainable Consumption and Production) where the estimated resource need in Ecuador is US$1,296 million in total. This estimate includes measures to increase the share of alternative energy to 6%, provide incentives for responsible consumption and tax incentives for innovation of ecosystem-friendly products. In contrast the modest estimate in the HLP (2012) report was based on the cost of studies and plans only, not implementation. There are similar reasons for the differences for Targets 2 (biodiversity values) and 3 (incentives). In contrast the estimates for Targets 5 (reducing habitat loss), 9 (invasive alien species) and 12 (species conservation) are based on more modest assumptions about the actions required. Detailed costings are not provided.

[72] Examples from the regional reviews include awareness raising (Target 1) and national accounting measures (Target 2), in Guatemala, wetland conservation in Germany (Target 5), protected areas in Latin America and the Caribbean (Target 11, see box above), and traditional knowledge in Palestine (Target 19)

Box 67 Regional evidence from Latin America and the Caribbean – comparison with HLP (2012) report

The review found relatively little quantitative evidence of the resources required to deliver the Aichi Targets. There is therefore limited scope to make direct comparisons with the previous estimates in HLP (2012).

The evidence suggests that high levels of investment will be needed to deliver Targets 5 (averting habitat loss) and 11 (protected areas). This is in line with the findings of HLP (2012) which identified these as the Targets requiring high levels of investment. However, no evidence was found on the overall costs of meeting Targets 8 (pollution control) or 14 (ecosystem restoration), which were also found by the first report to be among the most resource intensive targets to deliver.

The best evidence of costs at regional level relates to protected areas (Target 11). It is estimated that overall expenditures on the management of protected areas currently amount to US$1.4 per hectare per year in South America and US$4.6 per hectare per year in Central America, but that there is currently a significant funding gap which prevents optimal management being achieved. Estimates of optimal levels of expenditure on protected areas suggest an average resource requirement in the order of US$4.6 per hectare per year in South America and US$10.7 per hectare per year in Central America. These estimates are broadly in line with those used in HLP (2012) which estimated overall annualised resource needs (including investments and ongoing management costs) in a broad range of US$1–10 per hectare per year.

Other findings on resource needs also support the findings of the HLP report to COP 11, including:

The importance of investment in governance, institutions, capacity and enabling policies, which, while it may not require very high levels of investment, plays an essential role in meeting the range of Aichi targets;

The significant gaps in funding that currently exist relative to resource needs, and are a key factor in constraining delivery of the Targets; and

The synergies and overlaps between Targets, which need to be considered in assessing the types of investments needed and the levels of resources required.

- However, some national and regional estimates suggest that the unit costs used in the HLP (2012) report may be underestimates. Examples include estimates of the resources required for actions to promote sustainable consumption and production in East Africa and in Ecuador (Target 4), sustainable forestry in Costa Rica (Target 7), protected areas in North America and Europe (Target 11), species protection measures in the EU (Target 12) and biodiversity research in the EU (Target 19).

No examples could be found that suggested that overall resource requirements are likely to be lower than comparable estimates made in HLP (2012).[73]

In general, therefore, it appears that the top down estimates of resource needs in HLP (2012) are broadly consistent with available assessments at the national, regional and global levels. Where there are differences, the evidence tends to suggest that the HLP first report's estimates may have been rather conservative for some targets. In particular, the top down global assessment in HLP (2012) came up with lower estimates for some targets than are suggested in estimates for some high income regions, such as the EU, where land and labour costs are high. In addition, estimates for Targets 2-4 in HLP (2012) are low compared to some other assessments as they are based on the costs of studies and plans, rather than the full resources required to implement policy change.

The benefits of meeting the Targets will greatly exceed the costs

The HLP first phase report concluded that, although it is clear that significant national and international

[73] The HLP (2012) report made relatively high estimates of the costs of controlling invasive alien species (Target 9), but these related to the total global costs of meeting the target, whereas other estimates look at current expenditures

investments will be required to meet the Targets, available evidence indicates that the scale of the benefits that would be provided to the economy and society at local, regional and national levels are likely to be significantly greater, and should outweigh these resource requirements. This is supported by the few available assessments that have been made of the global costs and benefits of biodiversity action. For example, Balmford *et al*. (2002) found that returns on the first US$45 billion invested annually would be 100:1.

Numerous examples of the costs and benefits of delivering relevant actions were found in the regional reviews. While there is strongest evidence for Europe and Asia, the evidence collated suggests that the benefits of delivering the Targets will exceed the costs in all regions.

For example, in Australasia and the Pacific, studies of the benefits of MPAs tend to show that their benefits usually exceed their costs by a factor of at least 2:1. The Box below demonstrates that benefit cost ratios for conservation action can vary widely according to local circumstances – in this case the key variables are tourism activity and coastal protection functions.

In Latin America, the strongest evidence of costs and benefits relates to forest conservation, where studies have shown that the net benefits of conservation through REDD+ and other PES schemes widely exceed the opportunity costs, particularly through avoided CO_2 emissions particularly in marginal lands use by small poor farmers. Overall, evidence suggests that the services delivered by the most important ecosystems in the region such as mangroves, tropical forests and wetlands are likely to be worth many hundreds of billions of dollars per year. Many of these benefits are enjoyed globally as well as locally. The costs of securing these services have not been estimated at regional scale, but are likely to amount to tens of billions of dollars annually.

However, a few examples were found that suggest that the costs of conservation can exceed the benefits at the local level. This may be the case where there is limited local demand for ecosystem services, and/or where the opportunity costs of conservation are particularly high. Some of these studies cover only certain ecosystem services or focus on short term costs and benefits.

For example, in China, Zhongmin *et al*. (2003) and Su and Zhang (2007) found that the costs of restoration and conservation clearly outweighed the benefits. In the former case, this was due to the low population density in the vicinity of the restored ecosystem, and therefore a low number of ecosystem service beneficiaries. Estimates of local WTP therefore did not justify restoration costs, although inclusion of wider benefits may alter the equation. In the latter case, the principal reason was that the wetland ecosystem assessed is close to Shanghai and so the opportunity cost of wetland was very high. However, the authors noted that, while this evidence may suggest that

Box 68 Cost-benefit analysis of Marine Protected Areas (MPAs) in Fiji and Vanuatu

An appraisal of the economic benefits of community-based Marine Protected Areas (MPAs, as required by Aichi Target 11) was conducted in 10 villages in Vanuatu and Fiji (Pascal, 2011).

The observed costs of community based MPAs are between US$1,500-10,000 per km^2 of protected area per year. The economic effects of MPAs have been estimated between US$110,000-530,000 per km^2 of protected area per year.

All the studied MPAs have produced positive cost benefit ratios demonstrating that investments in marine reserves (e.g. to reduce risk of overfishing and to conserve coral reefs) are an effective means to contribute to local economic development. The ecological effects on fish populations and habitats in the MPA have produced concrete and tangible benefits both for the villages with MPA and the surroundings villages. The ratio of benefits to costs depends on variations in tourism benefits and coastal protection values.

Box 69 Mozambique: Benefits of sustainable natural resource management exceed costs

In Mozambique, as in most other African countries, renewable natural resources make a significant contribution to peoples' livelihoods and the economy, but this is not all captured in official statistics. Estimates suggest that their contribution is in the order of 47-50% of GDP. As a rapidly developing country, Mozambique's natural systems have suffered from soil loss, deforestation, water pollution and the overexploitation of natural resources. These losses, as well as the inefficient use of resources, material and energy, have been estimated to cost the equivalent of 17% of GDP annually. Excluding inefficiencies, environmental degradation costs the Mozambican economy between 6 and 11% of GDP (Bandeira *et al*. 2012). This includes agricultural soil degradation worth some US$108 million. Based on the estimated costs of required investments in environmental protection, the overall benefit/cost ratio of preventing these losses was estimated to be 1.8. The analysis indicated that investments to reduce soil degradation, deforestation and to enhance coastal protection would bring the highest returns of all the actions considered. Investments in improved access to clean water and reduction of water pollution, air pollution and waste management also had positive net benefits (Bandeira *et al*. 2012).

meeting biodiversity targets in more developed areas is costly, caution is needed because of gaps in our knowledge about the benefits of ecosystems.

Other studies show that, where biodiversity loss is driven by short term gains, these may be outweighed by the long term benefits of the conservation and sustainable use of biodiversity. For instance, Van Beukering *et al*. (2003) showed that short term gains from deforestation were more than offset by long term losses over a 30-year time horizon.

There is evidence that the balance of benefits and costs of biodiversity action can vary spatially according to factors such as the productivity of soils, which have been shown to influence the attractiveness of PES schemes in Costa Rica. Naidoo and Ricketts (2006) found that spatial variations influence the balance between the benefits and opportunity costs of conservation of Atlantic forest in Paraguay, even in a relatively small area. The estimated balance of costs and benefits can also be sensitive to variables used in the analysis – such as the assumed carbon price and discount rate, which are key variables in the appraisal of the costs and benefits of forest conservation.

These studies help to illustrate the reasons for biodiversity loss, which may be driven by localised and short-term decisions, even where there is evidence that conservation and sustainable use of biodiversity deliver long term net gains globally.

Evidence of the net benefits of biodiversity action applies to a range of Aichi Targets

For some Targets, global assessments have been made of the benefits and costs of biodiversity action. For example, evidence suggests that the benefits of achieving sustainable fisheries (Target 6) will be sufficient to repay the costs within 12 years (Box 70).

There is also strong global evidence that the benefits of forest conservation measures substantially outweigh the costs, particularly due to reductions in carbon emissions. REDD+ schemes are therefore found to be a cost-effective means of achieving global emission reductions, helping to secure global benefits by meeting the local costs of conservation (Box 71).

Box 70 Benefits of Rebuilding Global Marine Fisheries Outweigh Costs (Target 6)

Sumaila *et al.* (2012) estimated the costs and benefits of rebuilding global marine fisheries. They noted that global marine fisheries are currently underperforming, largely due to overfishing. By analysing global databases the authors found that resource rent net of subsidies from rebuilt world fisheries could increase from the current negative US$13 billion to positive US$54 billion per year, resulting in a net gain of US$600 to US$1,400 billion in present value over fifty years after rebuilding.

To realise this gain, governments need to implement a rebuilding program at a cost of about US$203 (US$130–292) billion in present value. The real cost to society of rebuilding fisheries is negative, once the elimination of an estimated US$19 billion per year of harmful and ambiguous subsidies is taken into account. However, fishing enterprises and fishers will lose profits and wages during rebuilding. Temporary investment is therefore needed, largely in the form of compensation for decommissioning vessels and the costs of retraining crew.

The authors estimated that it would take just 12 years after rebuilding begins for the benefits to surpass the cost. Even without accounting for the potential boost to recreational fisheries, and ignoring ancillary and non-market values that would likely increase, the potential benefits of rebuilding global fisheries far outweigh the costs.

Box 71 Benefits and Costs of REDD+

Eliasch (2008) estimated that the global forest sector produces 5.8 $GtCO_2$ annually from deforestation, around 96% of which is estimated to come from developing countries in the tropics. Deforestation emits significantly more CO_2 than can be sequestered by an equivalent area of land forested in temperate regions.

The review estimated that the funds required to halve global emissions from the forest sector by 2030 could total US$17 – 33 billion per year, based on various models and taking account of both the opportunity costs of conservation and economic rents. However, the global economic cost of climate change caused by deforestation could reach US$1 trillion a year by 2100. The likely cost of action to curb emissions from deforestation is therefore a small fraction of the possible cost of inaction, even without taking account of the wide range of other ecosystem services that forests deliver.

Curbing deforestation was therefore found to represent one of the most cost-effective and fastest means of mitigating emissions. Some progress is being made towards this goal, with many tropical forest countries moving forward with REDD+ readiness and some countries initiating demonstration projects and some larger-scale activity. However, rapid deforestation and forest degradation is continuing in many forested nations as a result of logging, clearance for agriculture and other factors.

PWC (2011) noted an important distinction between the balance of marketed and unmarketed benefits and costs. Under the existing economic system, forests are often worth substantially more cut down than standing. In many countries this situation is compounded by unclear legal frameworks and insecure land tenure. However, by capturing the global benefits of reducing carbon emissions, REDD+ seeks to introduce incentives to maintain forests and enable local and forest-dependent populations to act as stewards of the forest. Financing REDD+ will also support poverty alleviation and help conserve biodiversity and other ecosystem services in developing countries.

Table A6 summarises evidence relevant to different Aichi Targets. It shows that there is evidence of the net benefits of conservation action relevant to a wide range of Aichi Targets, especially Target 5 (reducing habitat loss), 8 (pollution control) and 11 (protected areas).

There is also growing evidence of the net benefits of green infrastructure in providing essential services. Control of invasive species (Target 9) and ecosystem restoration (Target 14) have been shown to support services such as water provision and purification at lower cost than capital investments in built infrastructure such as treatment plants.

Ecosystems provide some services more effectively than their man made alternatives. Maintaining ecosystems and their services will save costs compared to allowing them to decline

Bovarnick (2010) demonstrates that conservation actions, by maintaining ecosystems and their services, can be a cost effective means of addressing many of the priorities facing local communities and economies in the LAC region. In contrast ecosystem degradation can increase costs. For example, degradation of watersheds often requires increased water treatment infrastructure and sediment removal machinery; soil fertility degradation requires inputs of fertilizer and other chemical products; reduced natural pest control requires increases in pesticide use, crop variation and management efforts.

The regulating services provided by ecosystems are also cost-effective in their ability to avert environmental damage and its costs on society. Forests, mangroves, coral reefs, wetlands and coastal ecosystems are important in providing protection against floods and natural disasters. Degradation of these ecosystems places increasing damage costs on society, as well as necessitating investment in man-made infrastructure such as flood defences. In Mexico, low-lying coastal areas are vulnerable to sea-level rise; by maintaining protected areas (the Girjalva-Mezcapala-Usumacinta Delta complex, Los Petenes and Sian Kaan Chetumal Bays), residents and communities have received increased protection, especially in minimizing coastal erosion and reduced damage from storms and tidal surges.

Many of the benefits estimates for the Latin America and the Caribbean region are based on the avoided costs of ecosystem conservation. In Chingaza National Park, Colombia, the Bogota Water and Aqueduct Company saved more than US$15 million in treatment

costs in 2004 by investing in watershed improvements. In Honduras, the cloud forests of La Tiga National Park (23,871 ha) provide over 40% of the annual water supply to 850,000 people of Tegucigalpa.

The Catskill Mountains example in the US demonstrates (Box 72) demonstrates that ecosystem restoration has been more cost-effective in maintaining New York's water quality than the construction of filtration plant. This is also one of the first examples of a successful PES scheme in the US.

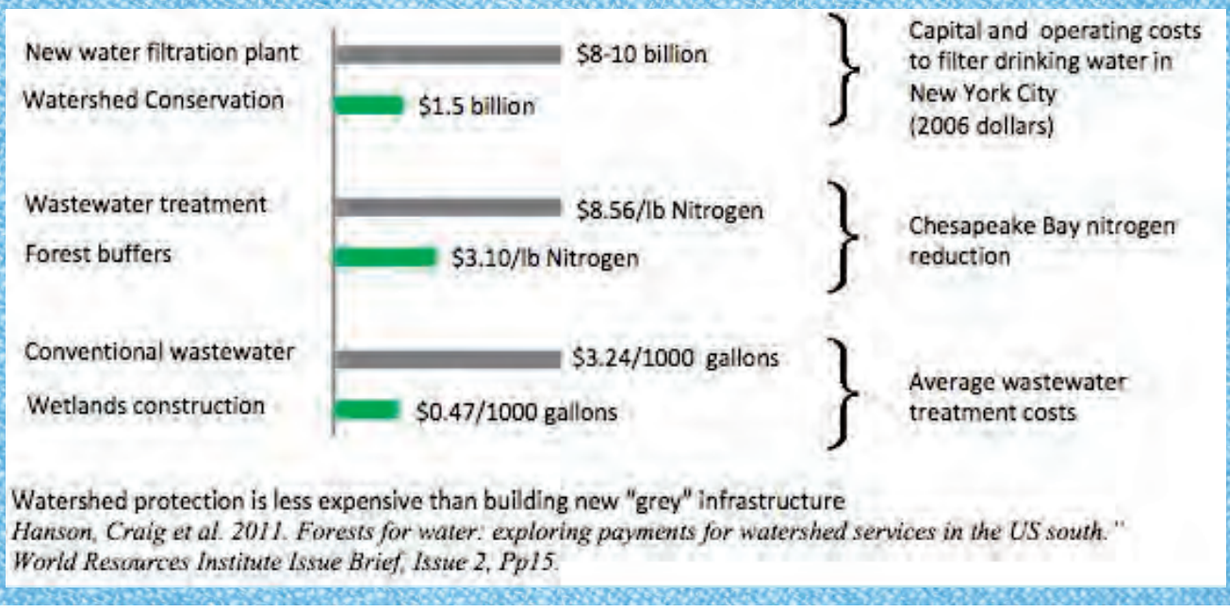
The ecosystem services considered here can be provided directly to people (e.g. rural communities benefiting from clean water extracted directly from a river, sand dunes and mangroves reducing sea storm surge) as well as in combination with built infrastructure, or integrated into the broader infrastructure system. For example, enhanced benefits from restoring upstream wetlands could be secured in addition to building a dam. This would decrease sedimentation into the dam and prolong its life. Existing examples show decreased costs

Box 72 Saving money by saving a watershed, New York City water treatment

One of the first and most widely known examples of a municipality using a cost/benefit analysis to calculate the value of services provided by natural ecosystem processes versus mechanized processes is that of the New York City Municipal Water Finance Authority. The case study is also one of the first examples of a successful payment for ecosystem services (PES) venture in the United States.

As New York's water quality began to drop in the 1990s, water managers discovered that the culprit was increased development in upstream rural areas of the Catskill Mountains, the city's watershed. Their analysis demonstrated that the option of paying for land protection activities within the watershed to achieve water quality was far less expensive than their previously preferred alternative-construction of a new and expensive water filtration facility, estimated to cost between US$8 billion and US$10 billion for initial construction and US$250 million annually for operation and maintenance.

Instead, New York City has committed approximately US$1.5 billion (averaging US$167 million per year) to for payments to land owners for the restoration of native habitat and the establishment of permanent conservation easements on the forestlands and open spaces around City reservoirs. Additional benefits of the choice to restore and preserve forestland in the watershed include carbon sequestration and outdoor recreational opportunities for citizens (Hanson *et al.* 2011).



Watershed protection is less expensive than building new "grey" infrastructure
Hanson, Craig et al. 2011. Forests for water: exploring payments for watershed services in the US south." World Resources Institute Issue Brief, Issue 2, Pp15.

to water companies from sustainable catchment management in addition to use of water treatment plants. Communicating all of these options to stakeholders will help ensure more uptake of 'natural infrastructure' options by other sectors, and thus increase the likelihood of funding.

Strategies to halt ecosystem degradation now will save the costs of their restoration in future. This is exemplified in Box 73. There is also strong evidence that intact ecosystems support more biodiversity and higher levels of ecosystem services than restored ecosystems (Rey Benayas *et al*. 2009).

Box 73 Action to control alien species is cost effective and will save future costs

Many studies have shown that the removal of Invasive Alien Species delivers net benefits in terrestrial and freshwater ecosystems, that swift action also pays off, and that the greater the initial investment the better the rewards over the long term.

In South Africa it is estimated that invasive alien species in mountain catchment areas and riparian zones have resulted in the loss of 695 million m^3 in water yields, or 4.1% of the registered total water use, and that if not controlled, this could increase to 16.1% (Cullis *et al*. 2007).

Projected increases in alien invasive species in the upper catchments of the Cape had the potential to result in the loss of more than 30% of the water supply to the City of Cape Town. Whilst the clearing of alien invasive species and management of upper catchments would by no means be a cheap operation, the alternatives to optimally managed catchments would be far from attractive, and would include the implementation of sewage effluent exchange and desalinization plants. Van Wilgen *et al*. (1996) found that these alternatives would deliver water at a cost between 1.8 and 6.7 times more than optimal catchment management.

Williams *et al*. (2010) examined the effect of the extent of invasion on control costs in relation to 5 invasive alien species in Great Britain (Asian long-horned beetle, carpet sea squirt, water primrose, grey squirrel and coypu). These case studies revealed an exponential increase in the costs of control as invasion progresses and demonstrated the benefits of intervention at an early stage, as well as the long term cost savings if eradication is undertaken early in the invasion process.

4.10 Key Message 10:

There is a need to increase investments substantially to bridge financing gaps

Estimates at global, regional and national levels all point to a substantial gap between the investments needed to deliver biodiversity targets and the resources currently allocated. This is true for all of the Aichi Targets.

Increases in dedicated funding for biodiversity action are needed but will not be sufficient. Closing the financial gap can only be achieved through realigning existing expenditures (particularly those which currently lead to biodiversity loss) with biodiversity objectives, and through improved sectoral integration. Most of the funding required to tackle the direct and indirect drivers of biodiversity loss will deliver multiple objectives and will require mainstreaming of biodiversity action into existing budgets.

In many areas there are significant shortfalls between the current allocation of resources and the resource needs

HLP (2012) found that, for most of the Aichi Targets, there is a substantial gap between the resources required and those currently being allocated nationally and internationally. This finding is supported by a range of global assessments of funding needs and allocations. Two significant recent assessments are presented in the boxes below.

Box 74 The funding gap for biodiversity action - Evidence from the Little Biodiversity Finance Book

A review of estimates of the costs of biodiversity conservation globally suggested a range of between US$300-400 billion annually. This includes annual costs of US$4-45 billion to expand the global protected area network to 15% of the world's land surface, while the cost of halting deforestation in developing countries alone is in the range US$25-185 billion per annum (Parker *et al.* 2012).

Although a significant portion of that cost may be funded through the private sector through the sustainable supply of ecosystems good and services, it will certainly require strong policy and public sector support to realise this level of funding. Whilst these costs seem high, the costs of inaction are far greater; one estimate is that if we continue to destroy biodiversity and ecosystems at the current rate we will lose ecosystems services worth 10-100 times the cost of protecting them.

Current levels of funding for biodiversity were estimated at between US$51-53 billion annually, of which only US$21 billion (41%) is spent in developing countries. Around 78% of the world's biodiversity finance is generated in what are traditionally considered developed economies, while about 22% is generated in emerging or developing economies. Nearly 19% of all biodiversity finance - approximately US$9.8 billion – is transferred internationally and delivered in emerging and developing economies, in roughly even proportions to Africa, Asia and Latin American and the Caribbean (LAC). The estimate of current biodiversity expenditure is greater than previous estimates. For example, IUCN (2012) reviewed a number of recent estimates which put expenditures at between US$4 and US$38 billion per annum.

These estimates suggest that current allocations of funding to biodiversity are between an eighth and a sixth of the levels required. There is a significant mismatch between the pattern of funding allocations and needs – while the majority of global biodiversity finance is delivered in the world's largest economies, the majority of the world's biodiversity exists in LAC, Africa, and Asia (excluding China), which receive far less biodiversity finance as well as being more directly dependent on ecosystem services for their well-being and livelihoods.

The authors examine a range of options to increase biodiversity funding. They conclude that a global scaling up of resources for biodiversity is needed, and that a range of market and non-market mechanisms need to be deployed to achieve this.

Box 75 Actual *vs* required expenditures for species protection and protected areas

McCarthy *et al.* (2012) estimated the costs of species conservation measures (Aichi Target 12) and protected areas (Aichi Target 11) globally and compared current expenditures to these estimated costs.

For threatened species they estimated that:

- The cost of reducing the extinction risk of all globally threatened bird species will be US$0.875 to $1.23 billion annually over the next decade
- Extending this estimate to incorporate threatened nonavian species increases this total to US$3.41 to $4.76 billion annually.
- Current funding represents only 12% of the estimated costs of avian species protection.

For protected areas they estimated that:

- The cost of protecting and effectively managing all terrestrial sites of global avian conservation significance (11,731 Important Bird Areas) would be US$65.1 billion annually.
- Adding sites for other taxa increases this to US$76.1 billion annually.
- Current annual expenditure on managing IBAs that are already under some form of protection falls short of requirements by US$1.09 billion annually in lower-income countries and by $2.82 billion annually in higher-income countries
- Current expenditures on already protected IBAs are estimated at 31% of estimated needs in lower income countries and 50% in higher income countries
- Management of an expanded protected area network covering all currently unprotected or partially protected IBAs increases the estimated shortfall to US$2.78 billion for lower-income countries and US$8.24 billion for higher-income countries.

While a significant shortfall in funding was identified, the authors found that the total costs are small relative to the value of the potential goods and services that biodiversity provides, estimating them to be equivalent to 1 to 4% of the estimated net value of ecosystem services that are lost per year (estimated at US$2 to US$6.6 trillion). They also estimated that the total required is less than 20% of annual global consumer spending on soft drinks.

Box 76 Modelling the funding gap for biodiversity action

Waldron *et al*. (2013) assembled a global database of annual conservation spending and developed a statistical model to analyse variation in conservation expenditures. They used their model to identify countries where funding is robustly below the expected levels. Key finding of their analysis include:

- They estimate that the total annual expenditure on global biodiversity was approximately US$21.5 billion for the study period (2001-2008);
- Their analysis of the drivers of spending explained 86% of the variance in biodiversity conservation investment. They identified that more threatened biodiversity, a larger area requiring conservation, higher costs, higher GDP and the nature of the governance structure all drove higher biodiversity conservation spending.

Based on their analysis of the geographical distribution of the most underfunded countries they found that:

- The 40 most severely underfunded countries contain 32% of all threatened mammalian diversity and include some of the world's most biodiversity-rich areas;
- Highly underfunded countries are often clustered in particular regions such that underfunding affects taxa across the entire ranges. This trend is of particular concern in the geographical grouping of Malaysia–Indonesia–Australia, a region that holds a very large amount of threatened biodiversity. There is also a pattern of underfunding in arid and semiarid lands across Central Asia, Northern Africa, and the Middle East, suggesting the possibility of global degradation of these biomes.

The Parker *et al*. (2012) study suggests that current levels of biodiversity expenditure, at just over US$50 billion annually, are between one sixth and one eighth of overall resource needs. McCarthy *et al*. (2012) estimate that current expenditures on species protection are less than one eighth of those required, and those for protected areas are less than one third of the levels needed in developing countries and approximately half of the levels required in developed countries. However, some caution is needed in interpreting these estimates, as they do not fully account for expenditures on related actions such as climate change and sustainable agriculture, which have the potential to benefit biodiversity. Nevertheless, they indicate a shortfall in funding even for biodiversity focused budgets.

Countries rich in biodiversity are often particularly affected by these funding gaps (Box 76).

For protected areas, Gutman and Davidson (2008) found that the total cost to governments for effective management of existing protected areas in developing countries ranges from US$1.1 billion to US$2.5 billion a year, with a funding shortfall of between US$1 billion and US$1.7 billion per year, partly because international

funding for biodiversity has failed to keep track with the growth in protected areas. In a study of management effectiveness of nearly 7,000 protected areas worldwide, Leverington *et al*. (2010) found that 13% had clearly inadequate management, 27% had basic management with major deficiencies, 35% had basic management, and 25% had sound management in place.

Regional Evidence

There is evidence from all of the world's regions that there are significant gaps between the resources currently allocated to biodiversity action and those needed to fund the investments required to deliver the Aichi Targets.

In Latin America and the Caribbean, it is estimated that funding for existing protected areas will need to increase by 2 to 3.2 times on current levels in South America to meet identified needs, and by 1.5 to 2.3 times in Central America. Total current funding for protected areas was estimated to amount to US$239 million per year in South America, and US$141 million in Central America. Financial gaps were estimated by considering current available resources and comparing these to the level of resources required under the basic and optimal scenario of management. The financial gaps were estimated to range from US$249 – 540 million per year for South America, and between US$78 and US$187 million per year for Central America. Expanding the protected area network to meet Aichi Target 11 for protected areas would increase funding requirements further. Since countries in the region estimate that their progress towards Aichi Target 11 is ahead of that for other targets, the funding gap for other Targets is likely to be greater (in relative terms) than that for Target 11.

In Belize, for example, national funding for protected areas is currently put at US$9 million per annum, compared to an annual need which is estimated to grow from US 19 to US29 million annually over the next 10 years. It is estimated that the annual funding gap will grow from US$10 to US$20 million per year unless new funding can be found. A UNDP-GEF project is examining how a range of taxes, charges and fees could close this funding gap.[74]

In **Europe,** available evidence suggests that biodiversity spending is well below 0.1% of GDP in most countries, and is thought to be insufficient to halt biodiversity loss. The estimated resources needed to implement the Natura 2000 network of protected areas are €5.8 billion (US$8.1 billion) per year. Current provision of funding is much less than this. Furthermore, the application of available EU financial resources for biodiversity action is often less than envisaged.[75,76] Examples of national funding gaps are given in Box 77.

[74] The Biodiversity Finance Initiative (BIOFIN) (2014) Transforming Policy and Finance Frameworks to Increase Biodiversity Investment. Presentation to workshop in Bratislava, 25.02.14. Note that Belize is not itself one of the countries implementing BIOFIN. The UNDP managed BIOFIN initiative aims to identify biodiversity financing needs and address funding gaps in 19 countries.

[75] For example, by September 2009, the uptake of EU Cohesion funds allocated to biodiversity was lower than for other spending categories. At that time, the uptake for the two categories directly related to biodiversity ("promotion of biodiversity and nature" and "promotion of natural assets") was 18% and 22% respectively, compared to an average of 27% for all Cohesion Policy funding.

[76] Problems related to financing include the short timeframes of funding programmes that are often not well suited to biodiversity needs; the lack of clear targeting of funds for biodiversity and the sectoral nature of much of the available funding, limitations in capacity among potential applicants, and the high administrative burdens associated with some of the funding programmes.

Box 77 Evidence of funding gaps from Europe

The costs for meeting **the UK**´s environmental targets for "biodiversity, landscape, climate change mitigation, flood risk management, farmland historic environment, soil quality, water quality, resource protection and public access" were estimated based on the established UK targets and current agri-environment payment rates, and assumes environmentally-effective management of all 16.2 million hectares of agricultural and forestry land in the UK. The total costs are estimated to reach €1.99 billion per year (US$2.91 billion per year), which is three times the existing annual agri-environment budget. It is stated, furthermore, that costs are probably significantly underestimated (Cao *et al*. 2009).

In **Switzerland**, a recent study estimated the financial resources required for the protection and maintenance of biotopes of national importance according to legal standards (which could be interpreted as Aichi requirements), and concluded that the yearly sum allotted presently by the Confederation and the cantons covers less than half the amount of funding necessary. The amount required would be US$172–213 million per year. In addition, a one-time investment in restoration measures amounting to US$815–1,748 million would be needed. The study concluded that it is impossible to satisfy legal requirements with the existing level of funding (FOEN, 2010).

In **Serbia**, the funding allocated to managing the protected areas of the country are estimated at only 25% of what is needed - a doubling of the spending would be necessary to cover basic functioning costs, a quadrupling for optimal functioning. The annual shortfall in protected areas financing in Serbia amounts to around US$8.7 million for basic costs (50% shortfall) and US$24.7 million for optimal functioning (75% shortfall)(Ministry of Environment and Spatial Planning of the Republic of Serbia, 2011).

In Asia, (with the possible exception of some Eastern Asian countries), there is likely to be a substantial gap between available and required resources for achieving the Aichi Targets. This has not been quantified at national levels but there are case study examples of large funding gaps. Many Asian countries report a general lack of funding for conservation actions. The extent of funding problems is rarely quantified in national reports or NBSAPs, but case study evidence shows that national funding shortfalls may be as high as 80%. Examples of funding shortfalls at national level are given in Box 78.

In North America, evidence from the USA suggests that the 30-year costs of establishing a comprehensive habitat conservation network would amount to between US$135 and US$927 billion depending on which management model is used (e.g. land rentals/ leases, fee-simple purchases or easements, or paying current landowners for management)(Casey *et al*. 2008). Actual spending was estimated to amount to US$32 billion between 1992 and 2001. Not only do these funds fall short of the amounts needed for a comprehensive habitat

Box 78 Evidence of funding gaps from Asia

The National Report from **Pakistan** states that while Biodiversity Working Group has been formed in the country, it has not been able to meet frequently due to financial constraints. Similarly the Biodiversity Secretariat and the Biodiversity Steering Committee has remained dormant due to financial inadequacies.

Afghanistan notes, "despite an expenditure of more than US$70 million in recent years, Afghanistan will not be able to meet the CBD's target of reducing the rate biodiversity loss by 2010 or in the foreseeable future". This may be because biodiversity conservation is simply not as high a priority as security, education and health. In addition, the war has eroded the institutional fabric of the country which needs to be restored first.

India identified that the functional needs for wildlife and protected area management efforts for the period 2008-13 would be approximately US$840 million, out of which the actual allocation is only half. The National Biodiversity Authority of India has been intensively working on Economic Valuation of Bio-resources for Access and Benefit Sharing as well. Nepal's national report also refers to unavailability of funds for the proposed US$86 million to be invested in priority biodiversity projects.

In **Armenia**, the government has worked hard to reverse the negative trends in natural and biodiversity conservation. In 1999 the Ministry of Nature Protection of the Republic of Armenia (MNPRA) noted a large funding shortfall for its biodiversity conservation programme. The US$800,000 budget for forest conservation was estimated to cover about 20% to 25% of the actual costs of sustainable forest protection. The 2008 budg*et al*location of US$1.38 million suggests there is still a significant problem of underfunding, particularly when accounting for inflation.

In **Indonesia**, uncontrolled forest fires have been identified as a key cause of habitat destruction. Among the key problems identified was weak enforcement of forest conservation rules and regulations caused by a wide range of resource and institutional failures. Out of 20 policy options that were identified, nine were ranked as high priorities. Through key informant interviews, the total additional fund required to implement the nine high priorities was estimated at 91,684 million rupiah (approximately US$8.2 million) or 315% of the existing amount for land and forest fire management.

protection system (estimated at US$5.4-7.7 billion per year), but funds are often directed toward ongoing and short-term fee-based programs, rather than land acquisition.

In **Africa**, few estimates could be found of the size of the funding gap, but the available evidence suggested that this is likely to be very large. In South Africa, where biodiversity conservation probably receives more attention than most other African countries, the annual management expenditure of protected areas in the Cape Floristic Region was found to be only 48% of what was considered adequate for effective management, and needed to be increased from US$6.7 million to US$13 million per annum (Frazee *et al*. 2003). In addition, South Africa has a major problem caused by acid mine drainage from mines that are abandoned after they become unviable. The cost of cleaning up the water pollution was estimated to be US$3 billion, but in the 2013 national budget, only US$15 million was allocated to this.

Recommendations

The World Economic Forum Global Risks report (WEF 2014) found that four of the eight worst global risks are ecosystem-based. The evidence presented in this report suggests that the costs to society of not implementing the CBD Strategic Plan and achieving the Aichi Targets are in many cases much higher than the resource needs for doing so; and that taking insufficient action to address biodiversity loss will risk losing current and future benefits that could become vital in the future

All countries should therefore develop plans to bridge biodiversity financing gaps. For core biodiversity conservation initiatives to protect vulnerable species and ecosystems, this will require countries to broaden the base of finance to increase the supply of sustained and predicable finance. To address the drivers of biodiversity loss throughout our economies and societies, countries will need to mainstream conservation and sustainable use across sectors, as well as private finance to realign current expenditures.

The High-Level Panel thus recommends a series of actions which it considers, if fully implemented, would enable countries to significantly reduce the additional resources required, and increase the cost-effectiveness of expenditure on biodiversity conservation and sustainable use. These actions are equally important for developed and developing countries. The High-Level Panel anticipates that its recommendations could inform direct action by countries and other stakeholders, as well as ongoing capacity development efforts.

1. **All countries should continue to urgently assess financing baselines, needs and gaps, and the full range of potential financing sources, as well as identify opportunities for improving cost-effectiveness in national biodiversity expenditure, anduse this information at the national level to understand where further action is needed and to help identify potential sources of finance**. National experiences, including lessons learnt from the BIOFIN initiative should be documented, collected and shared, including through the CBD Clearing House Mechanism (CHM) and the NBSAP Forum, and support mechanisms to accelerate learning should be developed. Donors and Parties from developed countries should consider providing bilateral and multilateral support to countries to implement steps embodied in the BIOFIN approach.

2. **Countries should develop strategies and policies to bridge the biodiversity finance gap with a broadened and diversified base of sustained and predictable sources of finance, including commitment of public funds through medium-term expenditure frameworks.** Countries should substantially increase and complement domestic biodiversity budgets, for example, through new and innovative financial mechanisms[77]as well as scaling-up current initiatives. The realignment of current expenditures must be the central part of the effort to bridge the gaps. There is also a strong role for governments to play in leveraging financing from the private sector, via incentives and economic instruments, by formulating and implementing necessary policies and enabling conditions, under appropriate safeguards.

3. **Biodiversity investments in marine, freshwater and terrestrial ecosystems need to be understood, presented and recognised as solutions to wider problems and challenges.** This requires better understanding and communication of the wider benefits of well-functioning ecosystems and the value of natural solutions in place of human-made alternatives. Countries and other stakeholders should make use of evidence from available studies, such as the High-Level Panel regional assessments, to build the business case for investments in biodiversity from across different sectors, and to communicate the benefits and the costs of inaction and delayed investments, particularly for poor segments of society. This should be communicated with tailored advice by national conservation-related ministries, NGOs and other

[77] www.cbd.int/financial/innovations/

agencies, to relevant stakeholders including other national governmental agencies, multilateral and bilateral donor agencies and development banks, focusing on the role of biodiversity in delivering objectives that they are expected to deliver. This will help to support mainstreaming of biodiversity conservation and sustainable use objectives into national and regional development plans and budgets, and the required changes in practice across sectors. This evidence should also be integrated into NBSAPs and regional biodiversity strategy and action plans.

4. **When developing international and national sustainable development goals and plans, countries should identify actions through which mainstreaming biodiversity can directly contribute to achieving such objectives and goals, in order to encourage biodiversity-positive development decisions.** This includes the contribution it can make to, for example, food security, water security, disaster risk reduction, livelihoods and poverty reduction, and national security, as well as to national revenue. Countries should explore specific mechanisms for doing this such as ecosystem accounting under appropriate biodiversity and social safeguards, and identifying and facilitating specific shifts in public sector policy to remove biodiversity-harmful incentives and subsidies. Biodiversity action at the national and local levels should take account of distributional impacts, to ensure that benefits for poor and vulnerable people are secured.

5. **As part of broader mainstreaming efforts, countries should further enhance the links between climate change policies, projects and programmes and biodiversity conservation and sustainable use. This has the potential to secure substantial additional funding for biodiversity action.** This would include the integration of biodiversity and ecosystem services into their National Climate Change Policy frameworks, and the development of ecosystem-based approaches to adaptation and mitigation. Such approaches can create sustainable and cost-effective solutions to the challenges posed by climate change.

6. **Governments should convene broad dialogue among governmental, private and civil society actors on the arguments for the integration of conservation and sustainable use principles into various sectors, and on practical options, to increase funding and to assist in mainstreaming conservation and sustainable use objectives.** In ensuring a cross-sectoral approach to the revision and implementation of NBSAPs, countries should identify relevant roles and responsibilities for all relevant stakeholders including, in particular, planning and finance agencies. This approach is essential for achieving broadly supported resource mobilization plans for implementing key strategies and actions.

7. **The in-kind contributions of indigenous peoples and local communities' collective actions, efforts and knowledge on the conservation and sustainable use of biodiversity, and provisioning of ecosystem services and functions, should be respected and taken into account when designing, resourcing and implementing interventions.** This should include clarifying and respecting the resource rights of indigenous peoples and local communities and enhancing their participation in the choice and operationalization of biodiversity-related policies and plans.

8. **Human and institutional capacity development programmes should include an increased focus on the sharing of practical knowledge and experience in developing effective policies and instruments for mainstreaming that support increased investment in conservation and sustainable use**; and enhance the role of regional and south-south cooperation and support. Lessons at both the national and international levels should also be sought and drawn from existing partnership approaches, such as where there is a shared agenda across developed and developing countries including those being utilised by the Wealth Accounting and Valuation of Ecosystem Services (WAVES) project, The Economics of Ecosystems and Biodiversity (TEEB[78]), and country-specific approaches such as the Mother Earth Approach[79].

9. **Countries should integrate into training, education and capacity building programmes, awareness of the economic rationale for action for biodiversity and ecosystem services,**

[78] http://www.teebweb.org/

[79] http://ucordillera.edu.bo/ descarga/livingwell.pdf

and their role in achieving sustainable development. Relevant modules should be included in secondary and tertiary education curricula, and new and existing civil society and private sector training programmes. Those focused on business management are especially important.

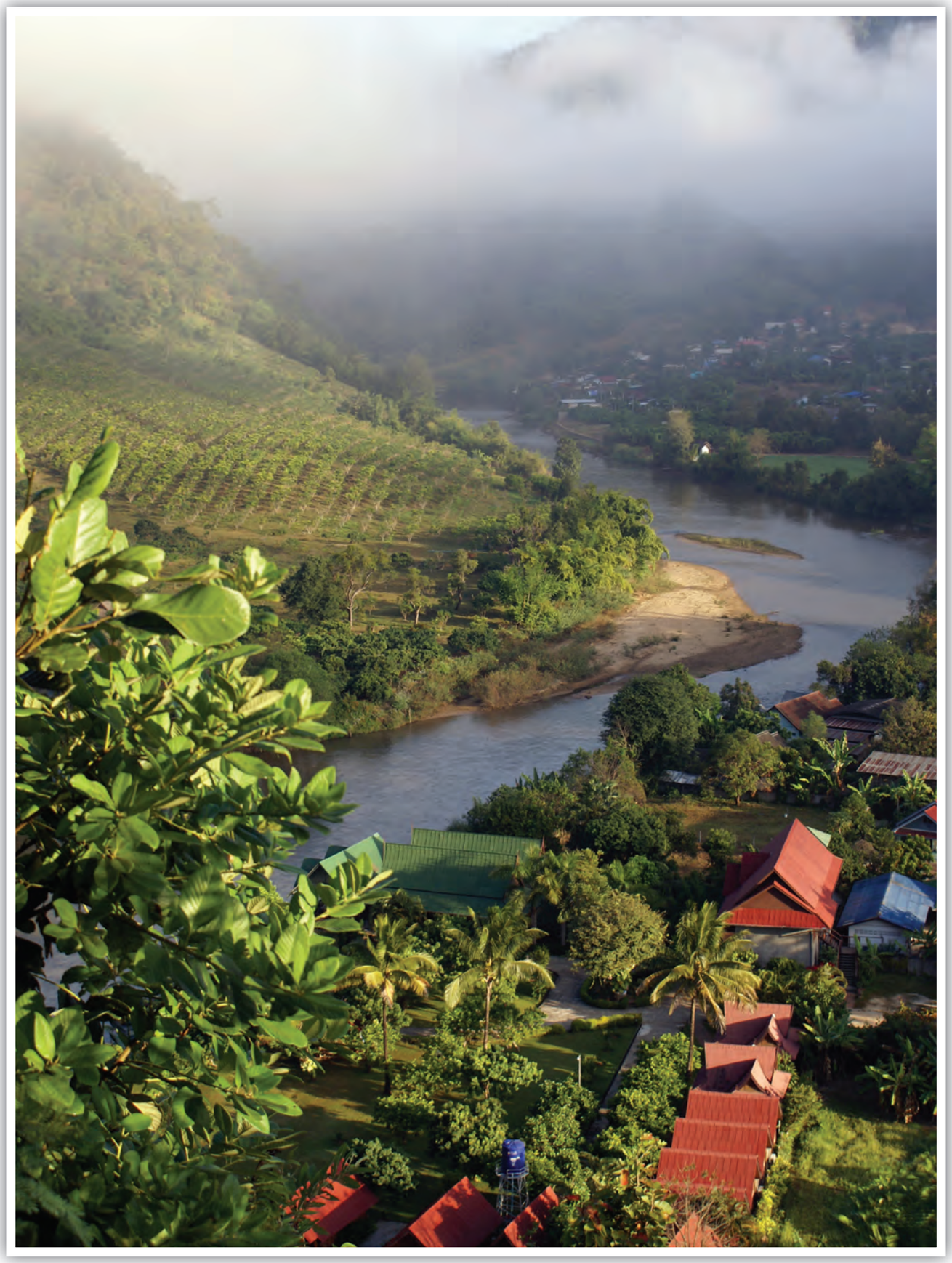
10. **Countries should include robust and verifiable baselines and indicators on the status and trends of biodiversity, ecosystems and ecosystem services within their local and national sustainable development plans and NBSAPs that will help to track and evaluate the benefits of biodiversity investments and promote their uptake more broadly**. In this respect, the High-Level Panel recommends the use of natural capital mapping as an assessment tool of ecosystems and their services; community-based monitoring and information systems; further research in ecosystem accounting and assessment of ecosystem resilience and thresholds; and the development and application of other appropriate methodologies. There is a strong role for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to support these efforts.

11. **Investments should be made in improved knowledge generation regarding the insurance value of biodiversity and better learning processes for adaptive governance of ecosystems** to avoid dangerous tipping points and regime shifts to cost-effectively increase the potential for sustainable development and well-being. This should be applied to policies and practices, including the use of appropriate financial measures that support various activities to protect biodiversity and ecosystem services, which are better guided by knowledge of the links between biodiversity and ecosystem function and the delivery of ecosystem services, and securing ecosystem resilience and the associated insurance values. They could be guided by methodologies such as ecosystem assessments[80], resilience assessments[81], Community Based Resilience Analysis (CoBRA)[82] and Strategic Environmental Assessments (SEAs), including associated risk assessments with scenario analysis, as well as the application of the precautionary approach.

[80] http://www.ecosystemassessments.net/

[81] http://www.resalliance.org/index.php/resilience_assessment

[82] http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_land_management/CoBRA.html



References

ACTeon Environment (2012). Comparative study of pressures and measures in the major river basin management plans in the EU - Task 4 b: Costs & Benefits of WFD implementation. Final Report to the European Commission.

Albán, M., Ulloa, R., Barrera, L., Busch, J., Vollberg, C., Suárez, L, de Koning, F. (2013). National level evaluation of financing needs for the implementation of the Aichi Biodiversity Targets in Ecuador. Ministry of Environment Ecuador, Conservation International Ecuador, Secretariat of the Convention on Biological Diversity. Ecuador.

ARCADIS (2011). Recognizing Natura 2000 Benefits and demonstrating the economic Benefits of Conservation Measures - Development of a Tool for Valuing Conservation Measures. Report to the European Commission.

Atilaw, A., and Korbu, L (2011). Recent development in seed systems of Ethiopia. Pages 1–93 in D. Alemu, S. Kiyoshi, and A. Kirub, editors. Empowering Farmers' Innovation - Improving Farmers' Access to Seed. Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia.

Ball, S. (2010). Biodiversity and certified community forest in Tanzania, ETFRN Newsletter 51-72

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R. E., *et al.* (2002). Economic Reasons for Conserving Wild Nature. Science, 297 (5583), 950-953

Bandeira, R.R. Ribeiro, R., Quenhé, C.S., Muzime, I., Ossene, A. (2012) Spatial dynamic of the Mabalane Mopaneecosystem degradation and its association with wildfires in southern Mozambique: What implications for biodiversity and people's livelihoods. Third Regional Universities Forum for Capacity-building in Agriculture Biennial Conference. Entebbe, Uganda, 24-28 September, 2012

Batker, D., de la Torre, I., Costanza, R., Swedeen, P., Day, J., Boumans, R., Bagstad, K. (2010). Gaining Ground.

Benítez, P., McCallum, I. Obersteiner, M., and Yamagata, Y. (2006) Global potential for carbon sequestration: geographical distribution, country risk and policy implications. Ecological Economics 60: 572-583.

Berg, Hakan, Marcus C. Ohman, Sebastian Troeng, and Olof Linden (1998). "Environmental Economics of Coral Reef Destruction in Sri Lanka." Ambio 27, no. 8. Building Capacity for Coastal Management: 627–634.

BIO Intelligence Service (2011). Estimating the economic value of the benefits provided by the tourism/recreation and Employment supported by Natura 2000. Final Report prepared for European Commission-DG Environment.

Boon, R. (2010). Spatial planning in the eThekwini Municipality (Durban), South Africa.

Boucher, D., P. Elias, K. Lininger, C. May-Tobin, S. Roquemore, and E. Saxton. (2011). The Root of the Problem: What's driving tropical deforestation today?

Bovarnick, A., Alpizar, F. and Schnelli, C. (eds) (2010). The Importance of Biodiversity and Ecosystems in Economic Growth and Equity in Latin America and the Caribbean: An economic valuation of ecosystems. United Nations Development Programme.

Braat, L., P. ten Brink, J. Bakkes, K. Bolt, I. Braeuer, A. Chiabai, H. Ding, H. Gerdes, M. Jeuken, M. Kettunen, U. Kirchholtes, C. Klok, A. Markandya, P. Nunes, M. van Oorschot, N. Peralta-Bezerra, M. Rayment, C. Travisi, and M. Walpole. (2008). The cost of policy inaction: The case of not meeting the 2010 biodiversity target. Wageningen, Brussels.

Brelaud, C., Couharde, C., Geronimi, V., d'Hotel, E.M., Radja, K., Schembri, P., Taranco, A. (2009). Capital naturel et développement durable en Nouvelle-Cale'donie. Etude 1. Mesures de la « richesse totale » et soutenabilité du de'veloppement de la Nouvelle-Calédonie. Agence Française de Développement - Série Documents de travail/Working Papers Series – Document de travail n° 82-Juin 2009.

Burke, L., and J. Maidens (2004) Reefs at risk in the Caribbean. Washington DC., USA: World Resources Institute.

Burke, L., Cooper, E. and Bood N. (2008) Coastal Capital: Belize – The Economic Contribution of Belize's Coral Reefs and Mangroves. Washington DC., USA: World Resources Institute.

Canadian Parks Council (2009) The Economic Impact of Canada's National, Provincial & Territorial Parks in 2009. A Technical Report prepared by The Outspan Group Inc. Amherst Island, Stella, Ontario.

Cao Y, Elliott J, McCracken D, Rowe K, Whitehead J, Wilson L. (2009) Estimating the Scale of Future Environmental Land Management Requirements for the UK, Report prepared by ADAS UK Ltd and Scottish Agricultural College for the Land Use Policy Group, London.

Casey, F., Michalak, J., Manalo, P. (2008) The Cost of a Comprehensive National Wildlife Habitat Conservation System. Report to the National Council for Science and Environment. Defenders of Wildlife. Conservation Economics Program, Washington DC.

Cassola R. (2010) TEEBcase: Financing conservation through ecological fiscal transfers Brazil, mainly based on Ring (2008). Available at: http://www.teebweb.org.

CBD (2010) COP 10 Decision X/2. Strategic Plan for Biodiversity 2011-2020. http://www.cbd.int/decision/cop/?id=12268.

CBD (2010) Global Biodiversity Outlook 3. Montréal, 94 pages. http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf

CBD (2011) Agriculture and fisheries and their impact on marine and terrestrial biodiversity. Regional Workshop for East Africa on Implementing National Biodiversity Strategy and Action Plans. Kigali, Rwanda, 27-30 June 2011.

CBD (2011). Collection of Submissions on Innovative Financial Mechanisms. UNEP/CBD/SRM/Innovative-Financial-Mechanisms/1. Secretariat of the Convention on Biological Diversity.

CBD (2013). Biodiversity for Food Security and Nutrition. CBD-Get Ready for 2015 newsletters, No. 5, July 2013

CBD (2013). Financial Planning for Biodiversity in Western Europe. Resource Mobilization Information Digest No 410.

CBD (2014a) Global Biodiversity Outlook 4. Montréal, Canada

CBD (2014b). Regional Research in Support of the Second Phase of the High Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020. CBD Technical Series 74. Secretariat of the Convention on Biological Diversity, Montreal, Canada.

Cesar, Burke and Pet-Soede (2003) in Conservation International, Economic Values of Coral Reefs, Mangroves, and Seagrasses: A Global Compilation. Center for Applied Biodiversity Science.

Chong, V.C. (2007). Mangroves-fisheries linkages: The Malaysian perspective. *Bulletin Of Marine Science*, 80(3): 755–772. Conservation International, Arlington, VA, USA.

Chenery, A., Booth, H., Secades, C., Mazza, L., Brown, C. and P. ten Brink (2013) Incorporating biodiversity and ecosystem service values into NBSAPs: Guidance to support NBSAP Practitioners.

Clements, T. Rainey, H., An, D., Rours, V., Tan, S., Thong, S., Sutherland, W.J., Milner-Gulland, E.J. (2013). An evaluation of the effectiveness of a direct payment for biodiversity conservation: The Bird Nest Protection Program in the Northern Plains of Cambodia. Biological Conservation, 157 (50-59).

Cooper, E., Burke, N. and N. Bood (2008) Coastal Capital. Economic contribution of coral reefs and mangroves to Belize. Washington DC: World Resources Institute

Costanza R., *et al.* (2014) Changes in the global value of ecosystem services. Global environmental change, Vol. 26, pp. 152-158.

Crafford, J., R. Strohmaier, P. Munoz, T. De Oliveira, C. Lambrechts, M. Wilkinson, A. Burger, and J. Bosch. (2012). The role and contribution of montane forests and related ecosystem services to the Kenyan economy. G.-M. Lange, J.-L. Weber, N. Hagelberg, and S. Muriithi, editors. UNON Publishing Services Section, Nairobi.

Croitoru, L. (2007) How much are Mediterranean forests worth? Forest Policy and Economics. 9. p.536-545.

Crossman, N.D., Bryan, B.A. and Summers, D.M. (2011). Carbon payments and low cost conservation. Conservation Biology, 25, 835-845

CSIRO (2012). Assessment of the ecological and economic benefits of environmental water in the Murray-Darling Basin. Canberra, Australia, CSIRO Water for a Healthy Country National Research Flagship.

Cullis, J. D. S., A. H. M. Gorgens, and C. Marais. (2007). A strategic study of the impact of invasive alien plants in the high rainfall catchments and riparian zones of South Africa on total surface water yield. Water SA 33:35–42.

Daly-Hassen (2013) Economic valuation of forest goods and services, Tunisia. Available at: TEEBweb.org.

Damodaran (2009) Risk management instruments for debt driven conservation efforts: The case of India's Project Tiger. Ecological Economics, vol. 68, issue 3, pages 625-633.

Damodaran (2012) 'The Economics of Coping strategies and Financing adaptation action in India's semi-arid ecosystems,'International Journal of Climate Change Strategies and Management' Volume 4(4), 2012.

Das, Bidhan Kanti. (2008). "The Policy of Reduction of Cattle Populations from Protected Areas: a Case Study from Buxa Tiger Reserve, India." Conservation and Society 6 (2): 185–189.

Davidson, S., Ennaanay, D., McKenzie, E. and Tallis, H. (2010) Water Funds for conservation of ecosystem services in watersheds, Colombia, available at: TEEBweb.org

Daya, Y., and N. Vink. (2006). Protecting traditional ethno-botanical knowledge in South Africa through the intellectual property regime. Agrekon 45:319–338.

De Merode, E., K. Homewood, and G. Cowlishaw. (2003). Wild resources and livelihoods of poor households in Democratic Republic of Congo.

DEFRA (2011) Appraisal of flood and coastal erosion risk management: A Defra policy statement.

DEFRA (2011). Biodiversity 2020: A strategy for England's wildlife and ecosystem services the fish site.

Dereczynski, C., W. L. Silva, W.L. and J. Marengo, (2013). Detection and projection of climate change in Riode Janeiro, Brazil. American Journal of Climate Change 2, p. 25-33

Donato, D., Kauffman, J. Murdiyarso, D *et al.* (2011) Mangroves among the most carbon-rich forests in the tropics. Nature Geoscience 4: 293-297

Dovie, D. B. K., C. M. Shackleton, and E. T. F. Witkowski. (2007). Conceptualizing the human use of wild edible herbs for conservation in South African communal areas. Journal of environmental management 84:146–156.

Dudley, N., S. Stolton, A. Belokurov, L. Krueger, N. Lopoukhine, K. MacKinnon, T. Sandwith and N. Sekhran [editors] (2010); Natural Solutions: Protected areas helping people cope with climate change, IUCNWCPA, TNC, UNDP, WCS, The World Bank and WWF, Gland, Switzerland, Washington DC and New York, USA

Earth Economics. (2010) Nature's values in the Terraba-Sierpe National Welands: The essential economics of ecosystems services.

EC (2011). Commission Staff Working Paper - Impact Assessment. Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (SEC(2011) 540 final).

EC (2011a). Commission Staff Working Paper. Financing Natura 2000 - Investing in Natura 2000: Delivering benefits for nature and people (SEC(2011) 1573 final).

EC (2011b). Commission Staff Working Paper - Summary of the Impact Assessment. Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (SEC(2011) 541 final).

EC (2013) Economic benefits of the Natura 2000 network: synthesis report.

EC (2013) The Common Agricultural Policy and agriculture in Europe- frequently asked questions.

Eliasch (2008) Climate Change: Financing Global Forests: The Eliasch Review. London, UK: Earthscan Publishing.

Emerton L., Erdenesaikhan N., de Veen B., Tsogoo D., Janchivdorj L., Suvd P., Enkhtseteg B., Gandolgor G., Dorjsuren C., Sainbayar D. and Enkhbaatar A. (2009). The Economic Value of the Upper Tuul Ecosystem, Mongolia, The World Bank, Washington DC.

Emerton, L. (2005). Making the Economic Links Between Biodiversity and Poverty Reduction: The Case

of Lao PDR, IUCN — The World Conservation Union, Ecosystems and Livelihoods Group Asia, Colombo

Emerton, L. (1997). Seychelles biodiversity: Economic assessment.

Emmerton, L. (2000) Using economic incentives for biodiversity conservation. Gland, Switzerland: IUCN.

Environmental Management Group (2013) Contribution of the United Nations System to the Implementation of the Strategic Plan for Biodiversity 2011-2020

EP (2012). Our life insurance, our natural capital: an EU biodiversity strategy to 2020. European Parliament resolution of 20 April 2012 on our life insurance, our natural capital: an EU biodiversity strategy to 2020 (2011/2307(INI)).

Failler, P., Petre E. and Marechal, J-P. (2010). Valeuréconomiquetotale des récifscoralliens, mangroves etherbiers de la Martinique. Available at: http://etudescaribeennes.revues.org/4410.

FAO. (2014). *State of the World's Forests*.

FOEN (ed.) (2010). Switzerland's Fourth National Report under the Convention on Biological Diversity, Bern

Folke C. (2011). Reconnecting to the Biosphere. Ambio Vol. 40, s.719-738

Förster, J. (2009). TEEBcase: Peatlands restoration for carbon sequestration.

Frazee, S. R., R. M. Cowling, R. L. Pressey, J. K. Turpie, and N. Lindenberg. (2003). Estimating the costs of conserving a biodiversity hotspot : a case-study of the Cape Floristic Region , South Africa. Biological Conservation 112:275–290.

Fukuda, S (2011) Agro-biodiversity in Ethiopia : a Case study of Community Seed Bank and Seed Producing Farmers. Pages 1–41 in. Empowering Farmers' Innovation - Improving Farmers' Access to Seed.

Gabrié C, Clément T, Mercier JR and You H (2010). Marine Protected Areas - Review of FGEF's co financed project experiences. GEF Evaluation Office. 2008. GEF impact evaluation. GEF protected area projects in East Africa.

Gallai, N., Salles, J., Settele, J., Vaissière, B (2008) Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecological Economics 68: 810-821

Gobin, C. (2012). CBD Side Event Highlights Effectiveness of Marine Protected Areas. The Global Environment Facility. http://www.thegef.org/gef/greenline/december-2012/cbd-side-event-highlights-effectiveness-marine-protected-areas.

Golden, C. D., Fernald, L. C. H., Brashares, J. S., Rasolofoniaina, B. J. R., & Kremen, C. (2011). Benefits of wildlife consumption to child nutrition in a biodiversity hotspot. Proceedings of the National Academy of Sciences of the United States of America, 108(49): 19653–19656

Grieg-Gran, M (2008) The Cost of Avoiding Deforestation: Update of the Report prepared for the Stern Review of the Economics of Climate Change, International Institute for Environment and Development, London.

Grieg-Gran, M. (2000). Fiscal incentives for biodiversity conservation: The ICMS ecológico in Brazil. Discussion Papers: 00-01. London: International Institute for Environment and Development

Gutman P. & Davidson, S. (2008). A Review of Innovative International Financial Mechanisms for Biodiversity Conservation: With a Special Focus on the International Financing of Developing Countries' Protected Areas, A Contribution to the COP9 of the CBD. WWF.

Hamilton (2013) Biodiversity and National Accounting. New York: World Bank.

Hanson, C., Talberth, J., Yonavjak, L., (2011). Forests for Water, WRI Issue Brief 2.

Harding, S., M. Vierros, W. Cheung, I. Craigie, and P. Gravestock. (2012). Cluster report on resource requirements for the Aichi Biodiversity Targets 6, 7, 10, 11: Marine cluster.

Headley, T. & Lisker, S. (2013) Oman's vision for sustainable management of produced water from oilfields. Majlis. 9. p.18-19.

Hicks, C; Woroniecki, S, Fancourt, M; Bieri, M, Garcia Robles, H; Trumper, K; Mant, R (2014) The Relationship between Biodiversity, Carbon Stock Resilience, and the provision of other Ecosystem Services. Critical Review for the Forestry Component of the International Climate Fund. Cambridge, UK.

High-Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity 2011-2020 (2012) Resourcing the Aichi Biodiversity Targets: A First Assessment of the Resources Required for Implementing the Strategic Plan for Biodiversity 2011-2020. http://www.cbd.int/doc/meetings/fin/hlpgar-sp-01/official/hlpgar-sp-01-01-report-en.pdf

Hussain, S. S., Brander, L., McVittie, A., Vardakoulias, O., Wagtendonk, A., Verburg, P., *et al.* (2011). The Economics of Ecosystems and Biodiversity Quantitative Assessment Final Report. Geneva: UNEP

IEEP (2011) Benefits of the Natura 2000 network. Report to the European Commission- DG Environment.

Institute for European Environmental Policy. (2012). Estimating the Overall Economic Value of the Benefits provided by the Natura 2000 Network . Retrieved from http://www.ieep.eu/publications/2012/06/estimating-the-overall-economic-value-of-the-benefits-provided-by-the-natura-2000-network

Ituarte-Lima, C., Schultz, M., Hahn, McDermott, C., and Cornell, S., (2014), Biodiversity financing and safeguards: lessons learned and proposed voluntary guidelines – Revised and expanded version of discussions papers on Safeguards UNEP/CBD/COP/11/INF/7 and UNEP/CBD/WGRI/5/INF/7, Montreal: Secretariat of the Convention on Biological Diversity.

IUCN (2009) The Financial Costs of REDD: Evidence from Brazil and Indonesia. IUCN: Gland, Switzerland.

IUCN (2012) Identifying and Mobilizing Resources for Biodiversity Conservation. https://cmsdata.iucn.org/downloads/identifying_and_mobilizing_resources_for_biodiversity_conservation.pdf

Jurado E.; Rayment M.; Bonneau, M.; McConville AJ.; Tucker G. (2012). The EU biodiversity objectives and the labour market: benefits and identification of skill gaps in the current workforce.

Kasthala, G., A. Hepelwa, H. Hamiss, E. Kwayu, L. Emerton, O. Springate-Baginski, D. Allen, and W. Darwall. (2008). An integrated assessment of the biodiversity, livelihood and economic value of wetlands in Mtanza-Msona Village, Tanzania. Dar es Salaam, Tanzania.

Knowler, D.J., MacGregor, B.W., Bradford, M.J., Peterman, R.M., (2003). Valuing freshwater salmon habitat on the west coast of Canada. J. Environ. Manage. pp. 69, 261–273.

Kuik O.; Brander L.; Schaafsma M. (2006). Globale Batenraming van Natura 2000 gebieden.

Lal, P., Kinch, J., (2005). Financial Assessment of the Marine Trade of Corals in the Solomon Islands. Apia, Samoa, SPREP and Foundation of the Peoples of the Pacific - International. Technical report, 28 pp.

Le Manach, F., C. Andrianaivojaona, K. Oleson, A. Clausen, and G.-M. Lange. (2013). Natural capital accounting and management of the Malagasy Fisheries Sector: A technical case study for the WAVES Global Partnership in Madagascar.

Leisher, C., Beukering, P.v., Scherl, L.M., (2007). Nature's Investment Bank: how marine protected areas contribute to poverty reduction Report The Nature Conservancy - Technical report, pp. 123 Available on: http://www.nature.org/initiatives/protectedareas/howwework/art23185.html.

Leverington, *et al.* (2010) Management effectiveness evaluation in protected areas – a global study. University of Queensland, Brisbane.

Lewis, D., S. D. Bell, J. Fay, K. L. Bothi, L. Gatere, M. Kabila, M. Mukamba, E. Matokwani, M. Mushimbalume, C. I. Moraru, J. Lehmann, J. Lassoie, D. Wolfe, D. R. Lee, L. Buck, and A. J. Travis. (2011). Community Markets for Conservation (COMACO) links biodiversity conservation with sustainable improvements in livelihoods and food production. Proceedings of the National Academy of Sciences of the United States of America 108:13957–13962.

Madsen, B., Carroll, N., Brands, K. (2010) State of Biodiversity Markets. Forest Trends,

Martinez *et al.* (2007) in Conservation International (2008) Economic Values of Coral Reefs, Mangroves and Seagrass. Center for Applied Biodiversity Science, Conservation International, Arlington, VA, USA.

Matthews, A. (2012). Greening the CAP: the way forward. Paper prepared for the 126th EAAE Seminar "New challenges for EU agricultural sector and rural areas - Which role for public policy?" Capri (Italy), June 27-29, 2012.

May, P., Veiga Neto, F., Denardin, V., &Loureiro, W. (2002). Using fiscal instruments to encourage conservation: municipal responses to the 'ecological' value-added tax in Parana´ and Minas Gerais, Brazil. In S. Pagiola, J. Bishop, & N. Landell-Mills (Eds.), Selling Forest Environmental

Services: Market-based Mechanisms for Conservation and Development (pp. 173–199). London: Earthscan

McCarthy D P, Donald P F, Scharlemann J P W, Buchanan G M, Balmford A, Green J M H, Bennun L A, Burgess N D, Fishpool L D C, Garnett S T, Leonard D L, Maloney R F, Morling P, Schaefer H M, Symes A, Wiedenfeld D A, Butchart S H M (2012) Financial Costs of Meeting Global Biodiversity Conservation Targets: Current Spending and Unmet Needs. Science. 16 November 2012 VOL 338

Miles, l., Trumper, K., Osti, M., Munroe, R., Santamaria, C. (2013) REDD+ and the 2020 Aichi Biodiversity Targets Promoting synergies in international forest conservation effort. A UNREDD policybrief

Ministério do Meio Ambiente (MMA) (2013) Estudoseconômicosemsustentabilidade (Ecometrika); ECONAMFI. Análise Econômica de Alternativas de Uso do Solo em Áreas de Preservação Permanente de Beira de Riosem Teresópolis: reflorestamento vs. ocupação antrópica. Relatório final de consultoria. Produto 4. Brasília. Not published

Ministry of Environment and Spatial Planning of the Republic of Serbia (2011). Biodiversity Strategy of the Republic of Serbia for the period 2011 – 2018.

Munang, R., Thiaw, I., Alverson, K., Mumba, M., Liu, J. & Rivington, M. (2013) Climate change and Ecosystem-based Adaptation: a new pragmatic approach to buffering climate change impacts, *Current Opinion in Environmental Sustainability,* Vol. 5

Muscat Daily. (2013) PDO may apply Nimr reed-bed project model in other oilfields. [Online]. Available from: http://www.muscatdaily.com/Archive/Business/PDO-may-apply-Nimr-reed-bed-project-model-in-other-oilfields-29b9. [Accessed: October 8th 2013].

Nahuelhual, L., *et al.* (2007). Valuing ecosystem services of Chilean temperate rainforests. http://www.cepal.org/ilpes/noticias/paginas/4/31914/Nahuelhual_07_Eco_Services_Chilean_forests_GOOD.pdf

Naidoo, R., Ricketts, T.H. (2006) Mapping the Economic Costs and Benefits of Conservation. PLo S Biology, Vol. 4, No. 11.

OECD (1999) Handbook of incentive measures for biodiversity. OECD: Paris, France.

OECD (2013) Scaling-up Finance Mechanisms for Biodiversity. OECD, Paris

Oladele, O. I. (2011). Contribution of indigenous vegetables and fruits to poverty alleviation in Oyo State, Nigeria. Journal of Human Ecology 34:1–6.

Oldfield, S. (2012). FSC Certification for maintaining ecosystem services, Tanzania.

Oleson, K. (in prep.). Taking an ecosystem service perspective in Velondriake locally managed marine area.

Oliver, T, K. Oleson, S. Benbow, D. Raberinary (in prep.) "The biological closure effect of temporary octopus closures in southwest Madagascar."

Oxford Economics (2009). Valuing the effects of Great Barrier Reef bleaching, Great Barrier Reef Foundation, Brisbane

Pagiola, S. (2008). Payments for environmental services in costa Rica. Ecological Economics 65(2008) 712-724.

Parker, C., Cranford, M., Oakes, N., Leggett, M. ed., (2012) The Little Biodiversity Finance Book, Global Canopy Programme; Oxford.

Pascal, N. (2011). Cost-Benefit analysis of community-based marine protected areas: 5 case studies in Vanuatu, South Pacific. Research report, CRISP-CRIOBE (EPHE/CNRS), Moorea, French Polynesia, 107pp

Pascal, N., (2013). Analysis of economic benefits of mangrove ecosystems. Case studies in Vanuatu: Eratap and Crab Bay. IUCN ORO International Union for Conservation of Nature and Natural Resources, Oceania Regional Office. Project MESCAL, Mangrove Eco Systems for Climate Change Adaptation & Livelihoods. Technical report, 147 pages.

Pendleton, L., Donato, D. C., Murray, B. C., *et al.* (2012). Estimating global "blue carbon" emissions from conversion and degradation of vegetated coastal ecosystems. PLoS ONE 7, 9: e43542. (doi:10.1371/journal.pone.0043542)

Pimentel *et al.* (1997) Economic and Environmental Benefits of Biodiversity. Bio Science, Vol. 47 (11): 747-757 47

Pollard S. R., Kotze D. C. and Ferrari G. (2008). Valuation of the livelihood benefits of structural rehabilitation interventions in the Manalana Wetland, in D. C. Kotze and W. N. Ellery (Eds) WET Outcome Evaluate: An Evaluation of the Rehabilitation Outcomes at Six

Wetland Sites in South Africa, WRC Report No TT 343/08, Water Research Commission, Pretoria

Portela, R. *et al.* (2012) Assessing and valuing ecosystem services in the ANKENIHENY-ZAHAMENA CORRIDOR, Madagascar: A Demonstration case study for the WAVES Global Partnership.

Poudel, Diwakar, and Fred H. Johnsen (2009). "Valuation of Crop Genetic Resources in Kaski, Nepal: Farmers' Willingness to Pay for Rice Landraces Conservation." Journal of Environmental Management 90: 483–491.

Prieur-Richard, A., Payet-Lebourges, K., Machalaba, C. and the DIVERSITAS Scientific Committee (2014) Contribution of Biodiversity to Sustainable Development Goals, DVERSITAS-ICSU policy brief.

PWC (2011) Funding for forests: UK Government support for REDD+

Rendón Thompson, O. R., J. Paavola, J. R. Healey, J. P. G. Jones, T. R. Baker, and J. Torres. (2013). Reducing emissions from deforestation and forest degradation (REDD+): transaction costs of six Peruvian projects. Ecology and Society 18(1): 17. http://dx.doi.org/10.5751/ES-05239-180117

Rey Benayas J M, Newton A C, Diaz A and Bullock J M (2009) Enhancement of Biodiversity and Ecosystem Services by Ecological Restoration: A Meta-Analysis. Science. Vol 325, 28 August 2009

Ring, I., 2008. Integrating local ecological services into intergovernmental fiscal transfers: the case of the ecological ICMS in Brazil. Land use policy 25(4), 485-497.

Rockström, J., and Schultz, M., (2011) Biodiversity and Ecosystem Insecurity - A Planet in Peril, Edited By Ahmed Djoghlaf and Felix Dodds, chapter 3. Contributing to Resilience, by J. Rockström and M. Schultz, Earthscan, 2011

Rogers, A.D., Sumaila, U.R., Hussain, S.S. and Baulcomb, C. (2014) The High Seas and Us. Understanding the value of High Seas Ecosystems. Global Ocean Commission 2014.

Rosendo, S., K. Brown, A. Joubert, N. Jiddawi, and M. Mechisso. (2011). A clash of values and approaches: A case study of marine protected area planning in Mozambique. Ocean & Coastal Management 54:55–65.

RSA and WWF (2014). Environmental Systemic Risk & Insurance. White Paper

Russi D., ten Brink P., Farmer A., Badura T., Coates D., Förster J., Kumar R. and Davidson N. (2013) The Economics of Ecosystems and Biodiversity for Water and Wetlands. IEEP, London and Brussels; Ramsar Secretariat, Gland.

Ryu, Dae-Ho, Lee, Dong-Kun (2013) "Evaluation on Economic Value of the Greenbelt's Ecosystem Services in the Seoul Metropolitan Region", Journal of Korea Planners Association 48(3); 279-292

Saenz Faerron Alexandra. (2008). Fonafifo: mas de unadecada de Accion (Costa Rica). In: Sarkis, S., Van Beukering P.J.H. and McKenzie, E. Total Economic Value of Bermuda's Coral Reefs: Valuation of Ecosystem Services. Available at: http://ipbes.unepwcmc-004.vm.brightbox.net/system/assessment/191/references/files/566/original/Total_Economic_Value_of_Bermuda_s_Coral_Reefs_Valuation_of_Ecosystem_Services_Technical_Report_2010.pdf?1364314252.

SANBI. (2012). Dialogue on ecological infrastructure. SANBI.

Sattout, E.J., Talhouk, S.N. & Caligari, P.D.N. (2007) Economic value of cedar relics in Lebanon: An application of contingent valuation method for conservation. Ecological Economics. 61. p.315-322.

Seenprachawong, U. (2003). Economic valuation of coral reefs at Phi Phi Islands, Thailand. International Journal of Global Environmental Issues 3(1): 104-114.

Solh, M., A. Amri, T. Ngaido, and J. Valkoun. (2003). Policy and education reform needs for conservation of dryland biodiversity. Journal of Arid Environments 54:5–13.

Su T. and Zhang, E. (2007). Ecosystem valuation and the conservation of wild lands in vigorous economic regions: A case study in Jiuduansha Wetland, Shanghai. Chinese Science Bulletin.

Sumaila UR, Cheung W, Dyck A, Gueye K, Huang L, *et al.* (2012) Benefits of Rebuilding Global Marine Fisheries Outweigh Costs. PLoS ONE 7(7)

Sumalia, UR., *et al.* (2000) Addressing ecosystem effects of fishing using marine protected areas. ICES J. Mar. Sci. (2000) 57 (3): 752-760.

Sunderland, T. (2011) Food Security: Why is biodiversity important? International Forestry Review Vol.13(3), 2011

Technical Support Team (TST) to the Open Working Group on SDGs. TST issues brief: Biodiversity. Prepared for the 8th session of the UN General Assembly (UNGA) on Sustainable Development Goals (SDGs).

TEEB (2009) TEEB for Policy Makers- Responding to Nature

TEEB (2010) TEEB Synthesis Report

TEEB (2010a). Ecological and Economic Foundations. Chapter 5.

TEEB (2011) TEEB Quantitative Assessment

TEEB (2013). Scoping Study for Georgia: Main Findings and Way Forward.

TEEBcase (2010) by Rebecca L Goldman, Silvia Benitez, Alejandro Calvache,

TEEBcase (2010) by V. Arias, S. Benitez and R. Goldman (2010) Water fund for catchment management, Ecuador, available at: TEEBweb.org.

Teh L.C.L., Teh L.S.L., Chung F.C. (2008) A Private Management Approach to Coral Reef Conservation in Sabah, Malaysia. Biodiversity and Conservation 17 (13): 3061:3077.

The Biodiversity Finance Initiative (BIOFIN) (2014) Transforming Policy and Finance Frameworks to Increase Biodiversity Investment. CBD Second Dialogue Seminar on Scaling up Finance for Biodiversity, 25.02.14.

Tucker, G.; Underwood, E.; Farmer, A.; Scalera, R.; Dickie, I.; McConville, A.; van Vliet, W. (2013). Estimation of the financing needs to implement Target 2 of the EU Biodiversity Strategy. Report to the European Commission. Institute for European Environmental Policy, London.

Turner, W. R., Brandon, K., Brooks, T. M., Gascon, C., Gibbs, H. K., Lawrence, K. S., *et al.* (2012). Global Biodiversity Conservation and the Alleviation of Poverty. BioScience, 62 (1).

Turpie, J. (2010). Water quality amelioration value of Fynbos Biome wetlands, South Africa.

Turpie, J., C. Marais, and J. Blignaut. (2008). The working for water programme: Evolution of a payments for ecosystem services mechanism that addresses both poverty and ecosystem service delivery in South Africa. Ecological Economics 65:788–798.

Turpie, J., J. I. Barnes, J. Arntzen, B. Nherera, G. Lange, and B. Buzwani. (2006). Okavango Okavango Delta, Delta, Botswana, Botswana,. Earth. Anchor Environmental Consultants.

UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, Cambridge.

UNDP-UNEP (2014) Poverty Environment Initiative (PEI) Annual Progress Report 2013

UNEP (2011) Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication

UNEP (2012a) Technical Report: Integrated Forest Services Kenya. UNEP, Nairobi, Kenya.

UNEP (2012b) The Role and Contribution of Montane Forests and Related Ecosystem Services to the Kenyan Economy. UNEP, Nairobi, Kenya.

UNEP (2013) South-originating green finance: exploring the potential. UNEP, Nairobi, Kenya.

UNEP (2014) The Importance of Mangroves to People: A Call to Action. van Bochove, J., Sullivan, E., Nakamura, T. (Eds). United Nations Environment Programme World Conservation Monitoring Centre, Cambridge. 128 pp.

UNEP. (2011). Creating the "New Normal" - Enabling the financial sector to work for sustainable development. Switzerland

UNEP-CBD (2013) Regional Workshop on the Aichi Biodiversity Targets, Los Angeles. 24-28th March 2013.

UNEP-UNDP (2013) Poverty Environment Initiative Annual Report 2012

UNEP-WCMC (2012) Promoting synergies within the cluster of biodiversity-related multilateral agreements

Union of Concerned Scientists (2008) Estimating the Cost and Potential of Reducing Emissions from Deforestation

van Beukering, P, Haider W, Wolfs E, Liu Y, van der Leeuw K, Longland M, Sablan J, Beardmore B, di Prima S,

Massey E, others. (2006). The economic value of the coral reefs of Saipan, Commonwealth of the Northern Mariana Islands.

van Beukering, P.J.H, Cesar, H., and Janssen, M.A. (2003). Economic Valuation of the Leuser National Park on Sumatra, Indonesia. Ecological Economics 44 (1) (February): 43–62. doi:10.1016/S0921-8009(02)00224-0.

Van Wilgen, B.W., Cowling, R.M. and Burgers, C.J.: (1996), 'Valuation of ecosystem services – A case study from South African fynbos ecosystems', Bioscience **46**, 184–189.

vanBeukering, P., Grogan, K., Hansfort, S., and Seager, D. (2009). An Economic Valuation of Aceh's Forests: The Road Towards Sustainable Development. R-09/14. Amsterdam: Institute for Environmental Studies.

Vantomme, P., D. Göhler, and F. N'Deckere-Ziangba. (2004). Contribution of forest insects to food security and forest conservation: The example of caterpillars in Central Africa.

Waldron A, Mooers A O, Miller D C, Nibbelink N, Redding C, Kuhn T S, Timmons Roberts J, Gittleman J L. (2013) Targeting global conservation funding to limit immediate biodiversity declines. PNAS, 16 July 2013, vol. 110, no 29.

White, D. (undated) Transaction and implementation costs of REDD+. Forest Carbon Partnership. Accessed at: https://forestcarbonpartnership.org/sites/forestcarbonpartnership.org/files/Documents/PDF/July2012/14%20-%20Transaction%20&%20Implementation%20Costs%20REDD+%20D.White_.pdf

Williams, F., Eschen, R. Harris, A., Djeddour, D., Pratt, C., Shaw, R.S., Varia, S., Lamontagne-Godwin, J., Thomas, S and S.T. Murphy (2010) The Economic Cost of Invasive Non-Native Species on Great Britain. CABI.

Woodward, R.T., Wui, Y-S. (2001) Economic valuation of wetland services; a meta-analysis. Ecological Economics, Vol. 37, pp. 257-270.

World Bank, 2009 The Sunken Billions. The Economic Justification for Fisheries Reform. World Bank and FAO 2009

World Economic Forum (2014) Global Risks 2014.

World Resources Institute. World Travel and Tourism Council (2012) Travel and Tourism Economic Impact 2012: Sub-saharan Africa

WWF (2012). Forest Management and Gender. Gender briefings http://www.wwf.org.uk/what_we_do/making_the_links/women_and_conservation/

WWF. (2008). Safety Net: Protected Areas and Poverty Reduction. p.46

WWF. (2009). Keeping the Amazon Forests standing: a matter of values. http://www.wwf.se/source.php/1229304/Keeping%20the%20Amazon%20forests%20standing.pdf

Yaron, G., Moepeng, P, Makepe, P, Mmopelwa D, Mookodi L and R Lekobane (2012), A Study of the Contribution of Sustainable Natural Resource Management to Economic Growth, Poverty Eradication and Achievement of NDP 10 Goals: Discussion Paper for UNEP UNDP PEI, Bidpa and GY Associates

Yaron, G., R. Mangani, J. Mlava, P. Kambewa, S. Makungwa, A. Mtethiwa, S. Munthali, W. Mgoola, and J. Kazembe. (2011). Economic analysis of sustainable natural resource use in Malawi.

Yoshida, K., *et al.* (2011) The Biodiversity Observation Network in the Asia-Pacific Region

Zekri, S., Mbaga, M., Fouzai, A. & Al-Shaqsi, S. (2011) Recreational value of an oasis in Oman. Environmental Management. 48. p.81-88.

Zhongmin, X., Guodong, C., Zhiqiang, Z., Zhiyong, S., and Loomis, J. (2003). Applying contingent valuation in China to measure the total economic value of restoring ecosystem services in Ejina region. Ecological Economics, 44, 345-358.

Annexes

Table A1: Examples of the value of Ecosystem Services

Service	Location	Value	Reference
Provisioning services	Mtanza-Msona Village, Tanzania	Wetlands and woodlands provide fuel, raw materials and wild foods worth US$107 per capita, or 37% of income	Kasthala *et al.*(2008)
Provision of fresh water	Upper Tuul watershed, Mongolia	NPV US$560 million over 25 years through conservation and sustainable use.	Emerton *et al* (2009)
Provision of fresh water	Catskill Mountains, US	Habitat restoration has avoided the need for water treatment plant with a capital cost of US$8 -10 billion and US$250 million annually for operation and maintenance	Hanson *et al.*, 2011
Provision of genetic resources	Nepal	WTP per farmer US$4.18 for *in situ* and US$2.20 for *ex situ* conservation per annum	Poudel and Johnsen (2009)
Coastal Protection	Great Barrier Reef, Australia	US$9 billion (NPV over 100 years with 2.65% discount rate)	Oxford Economics (2009)
Protection against rock falls and avalanches	Alpine Forests in Switzerland	US$2.0 to 3.5 billion p.a	Tucker *et al* (2013)
Pollination (insects)	EU	US$19 - 21 billion p.a.	EC (2013)
Recreation	Forests in Switzerland	US$11.6 billion p.a.	FOEN (2010)
Recreation	Misfat Al-Abryeen oasis, Oman	US$366,500 p.a.	Zekri *et al.* (2011)
Tourism	Great Barrier Reef, Australia	US$18.9 billion (NPV over 100 years with 2.65% discount rate)	Oxford Economics (2009)
Tourism	National Parks, Canada	Annual visitor spending of US$4.23 billion	Canadian Parks Council, 2009
Non-Use Values	Great Barrier Reef, Australia	US$14.2 billion (NPV over 100 years with 2.65% discount rate)	Oxford Economics (2009)

Table A.2: Values of Services delivered by different Ecosystems

Ecosystem	Location	Value	Services/ values	Reference
Cedar forests	Lebanon	US$42 per household per year	WTP for range of services	Sattout *et al*. (2007)
Forests	Mediterranean countries (Europe, N Africa, Middle East)	US$35-123/ha/year	Range of use and non-use values	Croitoru (2007)
Forests	Lao PDR - Nam Et-Phou Loei (NEPL) Protected Area	US$1.12 million per year or US$313 per household	Forest products – mostly home consumption	Emerton (2005)
Forests	Costs and benefits of water catchment conservation, Upper Tuul watershed, Mongolia	NPV of US$560 million over 25 years through conservation and sustainable use.	Water supply to Ulaanbaatar	Emerton *et al* (2009)
Forests	Leuser Forest Ecosystem, Sumatra, Indonesia	NPV of US$13.4 billion from forest conservation	Multiple ecosystem services	van Beukering *et al*., (2003, 2009)
Forests	Chile – temperate forests	US$250 – 462 /ha/yr	Multiple services – highest values for water supply	Nahuelhual, L., *et al*. (2007)
Forests	UK	US$1.1 billion p.a. US$2 billion p.a. US$318 million p.a.	Carbon sequestration Recreation Landscape	UK NEA (2011)
Forests	Tunisia	US$142 million or US$120/ha per year	Largest benefits from forest products (55%) followed by erosion control (19%)	Daly-Hassen (2013)
Coral Reefs	Sri Lanka	US$14 million to 750 million per ha (NPV over 20 years)	Multiple services, especially tourism and erosion control	Berg *et al*. (1998)
Coral Reefs	Phi Phi Islands, Thailand	US$497 million / year, including US$205 million recreational values	Use and non use values	Seenprachawong (2003)

Ecosystem	Location	Value	Services/ values	Reference
Coral Reefs	Great Barrier Reef, Australia	NPV of US $53 billion (100yrs, 2.65% discount rate)	Range of values, especially tourism, non-use and coastal protection	Oxford Economics (2009)
Coral Reefs	Pacific Islands	US $506 – 17,873 / ha/ year	Tourism, coastal protection, fisheries and other services	Various
Coral Reefs	Caribbean	US $3.1 - 4.6 billion p.a.	Shoreline protection, tourism and fisheries	Burke *et al* (2004)
Wetlands	Sri Lanka, Iran	US$1000 to 2500 per hectare per year	Use and non-use values	
Wetlands	Terraba-Sierpe National Wetlands, Costa Rica	$US 287 million to $US 1,179 million per year (US$1828 – 7510 per hectare)	Various ecosystem services; highest values for recreation, water supply, waste treatment and disturbance regulation	Earth Economics (2010)
Wetlands	Mississippi River Delta, US	US$12 billion to $47 billion annually	Ecological and storm protection services	Batker *et al.* (2010)
Coastal wetlands	UK	US$2.5 billion p.a.	Storm buffering and erosion prevention	Defra (2011)
Mangroves	Bangladesh, Pakistan and India	US$1000- 1500/ha/yr		
Mangroves	Vanuatu	US$4300 – 8500 / ha/yr	Various services, especially carbon sequestration, tourism, coastal protection, fisheries and wood	Pascal, 2013
Mangroves	Martinique	US$24,500 per ha per yr	Various services, especially tourism	Failler *et al* (2010)
Sea grass	Martinique	US$28,100 per ha per yr	Various services, especially coastal protection and tourism	Failler *et al* (2010)

Table A3: Selected local and regional evidence of the benefits of achieving different Aichi targets

Aichi Target	Location	Benefits	Reference
3 – Incentives; 6 – sustainable fisheries	Latin America and the Caribbean	Around 60% of the region's fisheries are overexploited; reforming fisheries subsidies, estimated at US$1.9 billion per year would help to rebuild fisheries and enhance yields	Bovarnick et el (2010)
5 – Reducing forest loss	Latin America	10% reduction in annual deforestation would generate annual carbon savings of US$600 million to US$2.5 billion, depending on carbon price	Eliasch (2008); Bovarnick *et al*. (2010)
6 – Sustainable fisheries	Europe	Present value of losses to cod fisheries compared to sustainable yields: US$167 million in Baltic and US$254 million in North Sea	WWF-Germany (2002)
7 – Sustainable agriculture	River Murray, Australia	25% reduction in agricultural water abstraction could yield benefits to wetland habitats for which the public is willing to pay US$3 - 8 billion, plus lower estimates for amenity/aesthetic, carbon, tourism values, avoided water treatment costs.	CSIRO (2012)
8 – Pollution Control	EU27	Benefits of achieving good water quality status under Water Framework Directive – US$13 to 26 billion per annum	ACTeon Environment (2012)
9 – Invasive Alien Species	EU27	Annual damage by IAS estimated at US$17.3 billion	EC (2011b)
10 – Coral reefs	Pacific Islands	Estimated ecosystem values of coral reefs range from US$506 (Vanuatu) to US$17,873 per hectare per year in Northern Mariana Islands, including tourism, coastal protection, fisheries	Various
10 – Coral reefs	Caribbean	Conservation could avert expected annual services losses of US$350 – 870 million	Burke *et al* (2008)

Aichi Target	Location	Benefits	Reference
11 – Protected Areas	EU27	Benefits of Natura 2000 network are estimated at US$280-430 billion annually, and include a range of ecosystem services. Carbon storage and other regulating services, recreation, tourism and non-use values are substantial.	IEEP *et al* (2011)
11 – Marine Protected Areas	Yavusa Navakavu Locally Managed Marine Area (Fiji)	MPA has increased local fisheries yields and the incomes of local fishers	Leisher *et al.* (2007)
12 – Species conservation	Western Canada	Value of freshwater salmon habitat on the west coast of Canada is between US$938 and $4,977 per km	Knowler (2003)
13 – Genetic Diversity	Nepal	WTP per farmer to protect crop genetic resources - US$4.18 for *in situ* and US$2.20 for *ex situ* conservation per annum	Poudel and Johnsen (2009)
14 – Wetland restoration	Kalkense Meersen, Belgium	Flood mitigation benefits of US$892,000 to 2.3 million per annum	EC (2013)
14 and 15 – Ecosystem restoration	Global	A global meta-analysis of 89 restoration projects found that they increased biodiversity and ecosystem services by 44% and 29% respectively	Rey Benayas *et al.* (2009)
15 – Forest restoration	Latin America	Afforestation/reforestation of 4% of the area suitable would generate net benefits of US$1.1 billion to US$2.3 billion in the period 2000-2020.	Benites (2006)
16 – Nagoya Protocol; 18 – Traditional Knowledge	Southern Africa	Informal trade in medicinal plants is worth an estimated US$35 million, and a further $280 million is generated though re-sale of plant materials by secondary users. Traditional knowledge presents an opportunity for communities to generate income. Implementing the Nagoya Protocol should lead to more equitable sharing of benefits and increase incentives for conservation	Daya and Vink (2006).

Table A4: Contribution of the Aichi Targets to the proposed post-2015 Sustainable Development goals

SDG	Key Aichi Targets[83]	Comment
1. End poverty in all its forms everywhere	**Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks **Target 2** Mainstreaming biodiversity values into national and local development and poverty reduction strategies and into national accounting and reporting systems. **Target 18** Traditional knowledge, innovations and practices of indigenous and local communities; and full and effective participation	Investments in biodiversity will secure the long-term provisioning of ecosystem services and access to critical biodiversity resources on which poor and vulnerable communities depend; and can enhance societal resilience through safeguarding water, food security and improving livelihood options. Investments in biodiversity can provide direct benefits for the resilience of ecosystems and their contribution to ecosystem-based adaptation, including protection of the poor and vulnerable from natural hazards and extreme weather events. For benefits for the poor and vulnerable to be secured it will be essential to ensure full and effective involvement of local communities in conservation; and for conservation action to take into account and address the distribution of benefits to and within local communities. Improved mainstreaming of biodiversity into poverty reduction plans and programmes and their budgets will help secure co-benefits for poverty reduction from biodiversity conservation and sustainable use
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	**Target 7** Sustainable agriculture, aquaculture and forestry **Target 13** Maintaining genetic diversity **Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 3** Elimination of harmful incentives and development and application of positive incentives **Target 6** Sustainable management of fish and invertebrate stocks and aquatic plants **Target 9** Control and eradication of invasive alien species **Target 12** Species conservation **Target 16** Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization	Investments in biodiversity will deliver essential ecosystem services for the long term sustainability of agriculture and fisheries production Maintenance of genetic diversity provides the basis of the development of improved varieties and enhanced production and allows farming systems to adapt to ever changing conditions including pests and disease Many of the world's poor are directly dependent on biodiversity as a primary food source and for diversity of foods and nutrients. Investments in biodiversity, particularly conservation and sustainable use, and community management of primary food resources could make an important contribution to food security and nutrition.

[83] Abbreviated form of Aichi Targets. For full text see http://www.cbd.int/sp/targets

SDG	Key Aichi Targets[83]	Comment
3. Ensure healthy lives and promote well-being for all at all ages	**Target 8** Reduced pollution **Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems). **Target 13** Maintaining genetic diversity **Target 18** Traditional knowledge, innovations and practices of indigenous and local communities; and full and effective participation	Investments in biodiversity and ecosystems will maintain direct benefits to human health such as provision of food, fuel, medicinal plants; and the regulation of water quality and supply. Control of pollution will benefit public health and the wider environment Disturbances to biodiversity will have consequences for human health, including for transmission of disease and more coherent policies could protect human health from the negative consequences of biodiversity loss Green spaces in urban environments can provide health benefits including those related to conditions such as obesity, mental health, circulatory disease and asthma
4: Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	**Target 1** Education and awareness raising **Target 19** Improvement in knowledge, the science base and technologies	At local level effectively designed community conservation projects, that secure benefits for local communities including women and children, can contribute to education and the acquisition of skills
5: Achieve gender equality and empower all women and girls	**Target 14** Provision of essential ecosystem services... *taking into account the needs of women*, indigenous and local communities, and the poor and vulnerable. **Target 18** Traditional knowledge, innovations and practices of indigenous and local communities; and full and effective participation	Designed effectively, community conservation initiatives can provide many opportunities for empowerment of women. Addressing the distribution of monetary and non-monetary benefits to and within local communities, including for women, is likely to increase the cost effectiveness of activities towards conservation and sustainable use of biodiversity; as well as their social impact.
6. Ensure availability and sustainable management of water and sanitation for all	**Target 5** Reduced loss of all natural habitats by at least half **Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 8** Reduced Pollution **Target 4** Sustainable production and consumption **Target 11** Protected Areas **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks.	Investments in the protection, sustainable management and restoration of biodiversity and ecosystems such as wetlands, forests, grasslands and soils offer significant solutions to water security including through regulating climate and rainfall, enhancing water storage, regulating hydrological cycles and water flow, controlling land erosion, reducing water pollution and regulating water quality. Evidence from all regions of the world strongly endorses the value of 'natural infrastructure' for water quality and supply, and indicates reduced costs to water companies from sustainable catchment management in addition to use of water treatment plants. Natural solutions can be integrated into the broader infrastructure system.

SDG	Key Aichi Targets[83]	Comment
7. Ensure access to affordable, reliable, sustainable, and modern energy for all	**Target 7** Sustainable agriculture, aquaculture and forestry **Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks.	Investments in more energy efficient solutions can bring co-benefits for development goals and for the sustainable use of biodiversity, including reduced dependence on wood fuel. Whilst wood energy remains the primary energy source for many of the world's poor and wood fuel is increasingly used in developed countries with the aim of reducing dependence on fossil fuels, sustainable management of forests will contribute to the long term and sustainable provision of this resource
8.Promote sustained inclusive and sustainable economic growth, full and productive employment and decent work for all	**Target 4** Sustainable production and consumption **Target 6** Sustainable management of fish and invertebrate stocks and aquatic plants **Target 7** Sustainable agriculture, aquaculture and forestry	Economic sectors such as agriculture, fisheries and tourism will benefit significantly from investments in biodiversity, the sustained delivery of ecosystem services and in the improved sustainability of production systems. Investments in the Aichi Targets will help to create jobs and support new economic and business opportunities. For example, establishing protected areas will create new opportunities for tourism-related business and employment; and other activities, such as control of invasive alien species and restoration will lead to job creation
9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	**Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks **Target 19** Improvement in knowledge, the science base and technologies	Co-benefits for this goals and for biodiversity conservation could be secured with sufficient policy alignment, including through use of natural infrastructure to enhance resilience and delivery essential ecosystem services; enhanced Research and Development capabilities and increased access to ICT
10. Reduce inequality within and among countries	**Target 19** Improvement in knowledge, the science base and technologies **Target 20** Resource mobilization	Co-benefits for this goal and biodiversity conservation could be secured through policies and actions that enhance scientific and technological cooperation and technology transfer; develop capacity; and ensure adequate financial resources for biodiversity conservation and sustainable development including through ODA.

SDG	Key Aichi Targets[83]	Comment
11. Make cities and human settlements inclusive, safe, resilient and sustainable	**Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks **Target 2** Mainstreaming biodiversity values into national and local development and poverty reduction strategies and into national accounting and reporting systems **Target 8** Reduced Pollution **Target 11** Protected Areas	Investments in biodiversity (e.g. flood regulation through wetlands and forests protection) can make significant increases to disaster risk reduction and minimise the risk of damage and loss through extreme weather events Maintaining green infrastructure can deliver a range of benefits including climate and air quality regulation, health benefits, aesthetics and for tourism.
12. Ensure sustainable consumption and production patterns	**Target 4** Sustainable production and consumption **Target 1** Awareness raising **Target 2** Mainstreaming biodiversity values into national and local development and poverty reduction strategies and into national accounting and reporting systems. A number of other Aichi Targets will underpin this including Targets 5,7,8,14 and 15	There are direct overlaps between these two sets of goals. In addition addressing sustainable consumption and production, including through addressing the use of natural resources, will make a significant contribution to other goals including sustainable economic growth.
13. Take urgent action to combat climate change and its impacts	**Target 5** Reduced loss of all natural habitats by at least half **Target 10** Reduced anthropogenic pressures **Target 11** Protected Areas **Target 14** Provision of essential ecosystem services (through protecting and restoring ecosystems) **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks	Ecosystem-based mitigation and adaptation are cost effective and generate multiple benefits for society. Conserving and restoring forests and wetlands, and maintaining healthy oceans, make a significant contribution to climate change mitigation Investments in biodiversity can provide direct benefits for the resilience of ecosystems and their contribution to ecosystem-based adaptation (e.g. coastal protection from restoration of mangroves and coral reefs; flood regulation from forests and wetlands conservation) and enhance societal resilience through safeguarding water, food security and improving livelihood options.

SDG	Key Aichi Targets[83]	Comment
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	**Target 6** Sustainable management of fish and invertebrate stocks and aquatic plants **Target 8** Reduced pollution **Target 10** Minimize pressures on vulnerable ecosystems, including coral reefs **Target 3** Elimination of harmful incentives and development and application of positive incentives **Target 11** Protected Areas **Target 12** Species Conservation **Target 15** Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks **Target 16** Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization **Target 19** Improvement in knowledge, the science base and technologies	There are direct overlaps between this SDG and a subset of the Aichi Targets. In addition, the removal of harmful fisheries subsidies (Aichi Target 3) would contribute significant gains to returns from fisheries.
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	**Most Aichi Targets are relevant to this goal, most particularly** **Target 2** Mainstreaming biodiversity values into national and local development and poverty reduction strategies and into national accounting and reporting systems **Target 5** Reduced loss of all natural habitats by at least half **Target 9** Control and eradication of alien invasive species **Target 12** Species Conservation	**There are direct overlaps between this SDG and a subset of the Aichi Targets**

SDG	Key Aichi Targets[83]	Comment
	Target 15 Enhanced ecosystem resilience and the contribution of biodiversity to carbon stocks **Target 16** Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization **Target 17** National Biodiversity Strategies and Action Plans	
16.Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive at all levels	**Target 17** National Biodiversity Strategies and Action Plans	The economic development and job-creating opportunities presented by biodiversity can contribute to economic recovery post-conflict and to peace-building efforts. Similarly, cooperation over the management of shared natural resources can provide new opportunities for peace building
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	**Target 19** Improvement in knowledge, the science base and technologies **Target 1** Education and awareness raising **Target 2** Mainstreaming biodiversity values into national and local development and poverty reduction strategies and into national accounting and reporting systems. **Target 17** National Biodiversity Strategies and Action Plans **Target 18** Traditional knowledge, innovations and practices of indigenous and local communities; and full and effective participation **Target 19** Improvement in knowledge, the science base and technologies **Target 20** Resource mobilization	If sufficient policy coherence is achieved between the Aichi Targets and the Sustainable Development goals then mutually supportive action could create the necessary enabling conditions for both, including improved institutions, policy development, and increasing human capability to make informed decisions with respect to the environment and natural resources (including through enhanced data and monitoring). Adequate integration of biodiversity in the post 2015 framework would ensure delivery of co-benefits and could reduce overall financing needs

Table A5: Estimates of resource requirements from HLP (2012)

Target	Investment needs (US$ million)	Recurrent expenditure per annum[84] (US$ million)	Average annual expenditure (2013 – 2020) (US$ million)[85]	Other Aichi Targets impacted by the Target	Other Policy objectives linked to the Target
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society					
Target 1 – Awareness raising	54	440 – 1,400	280 – 890	All Targets	Cross-cutting
Target 2 – Biodiversity values	450 – 610	70 – 130	100 – 160	All Targets	Natural resource management
Target 3 – Incentives	1,300 – 2,000	8 – 15	170 – 270	1,2,4,5,6, 7,8,9,10,11, 12, 13,14,15	Natural resource management, economic efficiency, public finance, rural development, climate change mitigation and adaptation, fresh water
Target 4 – Sustainable consumption & production[86]	55 – 107	8 – 15	12 – 23	1,2,5,6,7,8, 10,11,12, 13,14,15	Natural resource management, climate change mitigation and adaptation, food security
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use					
Target 5 – Reducing habitat loss (forests[87] and wetlands)	152,300 – 288,800	13,300 – 13,700	39,200 – 52,100	6,7,8,11,12, 13,14,15,16	Fresh water, flood protection, climate change mitigation and adaptation, rural development, avoidance of desertification
Target 6 – Fisheries	129,900 – 292,200	800 – 3,200	16,900 – 40,000	4,5,7,8,10, 11,12,14	Fisheries, food security, economic development

[84] The timing of recurrent expenditures varies between the analyses. Some Targets are assumed to require annual expenditures over the whole period (2013 – 2020) while for others these expenditures are assumed to be required only after an initial investment phase. This affects the estimated annual averages over the period.

[85] These figures average the estimated total global resource needs (investment plus total recurrent expenditures) over the eight year period 2013 to 2020 to give a phased average annual requirement.

[86] These estimates focus on development of SCP studies, plans and strategies and the integration of biodiversity conservation into them. To actually achieve sustainable consumption and production would require much larger investments, estimated by the UNEP Green Economy report at US$1.0 – 2.6 trillion.

[87] The forest Targets (5, 7, 11 and 15) are inter-related and many of the costed actions contribute to more than one Target. The synthesis assigns each action to one Target to avoid double counting, while recognising that the Targets will also benefit from resources attributed to the others. The figures are in US$at 2012 prices and have not been discounted.

Target	Investment needs (US$ million)	Recurrent expenditure per annum[84] (US$ million)	Average annual expenditure (2013 – 2020) (US$ million)[85]	Other Aichi Targets impacted by the Target	Other Policy objectives linked to the Target
Target 7 – Sustainable Agriculture, Aquaculture and Forestry	20,800 – 21,700	10,700 – 11,000	13,200 – 13,600	4,5,6,8,9,10, 11,12,13,14, 15,16,18	Agriculture, rural development, food security, climate change mitigation and adaptation, protection against floods and natural hazards, avoidance of desertification
Target 8 – Pollution[88]	77,600 – 772,700	24,400 – 42,700	35,400 – 139,200	4,5,6,7,10, 11,12,14,15	Health, fresh water, agriculture, forestry, fisheries, rural development
Target 9 – Invasive alien species	34,100 – 43,900	21,005 – 50,100	23,300 – 52,900	5,6,7,10,11, 12,13,14,15	Economic efficiency, rural development, agriculture, forestry, fisheries
Target 10 – Coral reefs[89]	600 – 960	6 – 10	80 – 130	6,12,13	Fisheries, tourism
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity					
Target 11 – Protected areas (terrestrial and marine)[90]	66,100 –626,400	970 – 6,700	9,200 – 85,000	1,2,5,6,7, 8,10,12,13, 14,15	Climate change mitigation, fresh water, flood protection, rural development
Target 12 – Species conservation	–	3,400 – 4,800	3,400 – 4,800	5,11,13	Cross-cutting
Target 13 – Genetic diversity[91]	550 – 1,400	15 – 17	80 – 190	2,7,12	Agriculture, food security, rural and industrial development

[88] Excludes expenditure associated with reducing pollution associated with nutrient runoff from upstream agricultural operations to avoid double counting, given the overlaps with Target 7 (Agriculture).

[89] This figure is incomplete and is an under-estimate. It assumes that all expenditure associated with establishing coastal management frameworks (ICM frameworks) will be upfront investment; in reality a proportion of these costs may also be related to ongoing management (i.e. recurrent expenditure).

[90] This figure is that estimated by Ervin and Gidda. Separate analyses were made for the resource needs of marine protected areas (by Craigie and Gravestock), and for protecting and effectively managing terrestrial Key Biodiversity Areas (by Bird Life International and collaborators) but are not included in this table to avoid double counting. Bird Life estimated that the total costs of managing the terrestrial KBA network would be US$76.1 billion per annum between 2011 and 2020, comprising costs of effective management of US$17.9 billion and annual costs of expanding the PA network of US$58.2 billion. Craigie and Gravestock estimated the costs of the MPA network at US$0.8 to 5.9 billion per annum between 2013 and 2020, comprising one off-establishment costs averaging US$0.19 to 1.20 billion per annum and annual management costs of US$0.58 to 4.70 billion per annum. Summing these estimates of terrestrial and marine resource needs gives a total of US$77 - 81 billion per annum, towards the upper end of Ervin and Gidda's large range of estimates.

[91] Because of data gaps this figure is known to be an under-estimate.

Target	Investment needs (US$ million)	Recurrent expenditure per annum[84] (US$ million)	Average annual expenditure (2013 – 2020) (US$ million)[85]	Other Aichi Targets impacted by the Target	Other Policy objectives linked to the Target
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services					
Target 14 – Ecosystem restoration[92]	30,000 – 299,900	–	3,750 – 37,500	5,10,11, 12,13	Climate change mitigation and adaptation, fresh water, flood protection, agriculture, rural development
Target 15 – Restoration of forests	100	6,400	6,400	5,11,12,13	Climate change mitigation and adaptation, fresh water, flood protection, agriculture, rural development
Target 16 – Nagoya Protocol	55 – 313	–	7 – 39	1,2,4,5,10, 11,12,13, 18,19	Agriculture, rural and industrial development
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building					
Target 17 – NBSAPs	114 – 1,100	110 – 560	50 – 170	All Targets	Cross-cutting
Target 18 – Traditional knowledge	210 – 340	210 – 340	210 – 340	7,13,14, 15,16,19	Rural development, indigenous communities, economic development
Target 19 – Science base	1,800 – 4,200	1,400 – 1,600	1,600 – 2,100	All Targets	Cross-cutting
Target 20 – Mobilisation of financial resources	10 – 79	3 – 20	4 – 30	All Targets	Cross-cutting

[92] Excludes expenditure associated with forest landscape restoration to avoid double counting, given the overlaps with Target 15 (restoration of forests).

Table A.6: Costs and benefits by target

Target	Location	Evidence of benefits and costs	Reference
5 – Forest conservation and 11 – Protected Areas	Leuser forest ecosystem, Sumatra, Indonesia	Forest conservation delivers ecosystem services worth US$13.4 billion over 30 year period, compared to US$12.0 billion from deforestation. Conservation increases value of a range of services, especially carbon sequestration and water supply, outweighing foregone timber revenues	van Beukering *et al.*, 2003; 2009
5 – forest conservation; 11 – protected areas; 14 – forest restoration	Upper Tuul watershed, Mongolia	Forest degradation in the watershed is adversely affecting river and groundwater water supplies to Ulaanbaatar. Conservation and sustainable use would yield a net present value of US$560 million over 25 years, higher than under the status quo or rapid ecosystem degradation scenarios.	Emerton *et al.* (2009)
5 – forest conservation, 11 – protected areas	Cardamom Mountains, Cambodia	Forest conservation yields small net benefits, through carbon values alone, but this finding is sensitive to carbon price and discount rate	Grieg-Gran *et al.* (2008)
5 – forest conservation; 11 – protected areas	Rajiv Gandhi National Park and Dandeli Wildlife Sanctuary, India	Opportunity costs may exceed local value of NTFPs; however including wider ecosystem service values would alter this balance	Ninan *et al.* (2007a); Ninan *et al.* (2007b)
5 – forest conservation and 11 – protected areas	Mbaracayu Forest Biosphere Reserve, Paraguay	Global benefits of forest conservation (US$1.5m- 1.8m) greatly exceed costs (US$37,000-115,000) because of high carbon values; however local benefits are less than costs	Naidoo *et al.* (2006)
5 – forest conservation	Montane forests, Kenya	Deforestation reduced regulating services by US$68 million in 2010, which is 4.2 times higher than the actual cash revenue of US$16 million	UNEP (2012b); Crafford *et al.* (2012).
5 – wetlands conservation	Jiuduansha Wetland, Shanghai, China	Scarcity of land for development means opportunity costs of conservation are high; evidence suggests wetland conversion may deliver net benefits. However, caution is needed since full benefits of ecosystems are not understood.	Su and Zhang (2007)

Target	Location	Evidence of benefits and costs	Reference
6 – sustainable fisheries	Madagascar	A state/fishing industry partnership was set up to overcome over-fishing problems in the shrimp fishery, and established a new set of long-term, tradable licences in 2000. The shrimping industry has benefited through introduction of sustainable management regimes. Thebenefit:cost ratio is estimated at 1.5.	Rojat *et al.*(2004).
8 – Pollution control; 14 – wetland restoration	EU27	The annual benefits of reaching the objectives of the Water Framework Directive are estimated at US$13 to 26 billion and compare to costs of US$11 to 21 billion; the benefit-cost ratio is probably positive or neutral, but unlikely to be negative.	Kaphengst *et al* (2010)
8 – Pollution control	Baltic Sea, Europe	The people in the nine countries bordering the Baltic Sea are willing to pay approximately US$5.5 billion annually for a less eutrophic Baltic Sea, while the costs would amount to around US $3.3 billion annually.	Baltic STERN Secretariat 2013
8 – Pollution control	Chesapeake Bay watershed, US	Each US$1 spent on source-water protection saves an average of US$27 in water treatment costs	Chesapeake Bay Foundation (2012).
8 – Pollution control	United States	Annual spending on clean water and clean air in the United States ranged between US$26 and US$29 billion during the decade from 1999-2009, and delivered economic benefits of between US$82 and US$533 billion.	World Resources Institute (2010)
9 – Control of IAS; 14 – ecosystem restoration	Upper Catchments of the CAP, South Africa	Degradation of fynbos through increases in alien invasives in the upper catchments of the Cape had the potential to result in the loss of more than 30% of the water supply to the City of Cape Town. Investments in IAS control and catchment restoration were found to be between 1.8 and 6.7 times less expensive than man-made alternatives such as sewage effluent exchange and desalinization plants.	Van Wilgen *et al.* (1996)
10 - Coral reefs	Sri Lanka	Coral reefs are damaged by coral mining, because this delivers short term financial returns. However the economic costs of coral mining were estimated at US$110,000-7,360,000 compared to benefits of US$750,000-1,670,000 (NPV over 20 years in tourism areas). The highest costs were through decreased tourism (US$2-3 million) and increased erosion (US$1-4 million).	Berg *et al.* 1998

Target	Location	Evidence of benefits and costs	Reference
11 – Marine Protected Areas	Fiji and Vanuatu	Costs of community based MPAs are between US$15-100 per ha of protected area per year, compared with economic benefits of between US$1,100-5,300 per ha of protected area per year. All the studied MPAs produced positive cost benefit ratios.	
11 – Marine Protected Areas	UK	MPAs would deliver net benefits, with estimated benefit cost ratios of between 7 and 39.Benefits include food and raw materials, nutrient cycling, climate regulation, sea defence, research and education.	Defra (2009)
11 – Protected Areas	EU Natura 2000 network	Costs of implementing the network are estimated at US$7.7 billion per annum, and will help to secure the annual services of US$280-430 billion that the network delivers. Studies in France and Scotland both show benefit cost ratios of 7 to 1.	IEEP *et al* (2011)
11 – Protected Areas	Mozambique	Deforestation in mountain areas has caused losses in production in downstream areas due to siltation, of between US$40 and US$80 per hectare. Protected areas are estimated to bring annual production benefits of US$10 per hectare, compared to opportunity costs of US$1.8 per hectare.	Carret and Loyer (2003)
14 – Ecosystem restoration	Ejina ecosystem, China	PV of costs of ecosystem restoration effort estimated at US$650 million over 5 years compared to WTP of local population estimated at US$9 million over 20 years. Costs greatly exceed estimated benefits in this sparsely populated region. However, potential benefits to populations of other districts and global community are not estimated.	Zhongmin *et al*. (2003)
14 – Ecosystem restoration	Anne Valley, Ireland	Water purification has been achieved with lower capital costs through wetland restoration (US$1.3 million) than costs of constructing water treatment plant (US$2.1 million); wetland also delivers other ecosystem services worth US$830,000 annually.	EC (2011a)
14 – Ecosystem restoration	River Elbe, Germany	Floodplain restoration measures were estimated to deliver benefit: cost ratios of between 2.5 and 4.1.	Meyerhoff and Dehnhardt (2007)

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