

4 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are directed at a wide range of decision makers and stakeholders, including inter-governmental and other international bodies, national governments, local and regional authorities, business, civil society organizations and the scientific community. For details, please refer to the TEEB report chapters given at the end of each section.

MAKE NATURE'S VALUES VISIBLE

- **Conclusions:** The invisibility of many of nature's services to the economy results in widespread neglect of →*natural capital*, leading to decisions that degrade →*ecosystem services* and →*biodiversity*. The destruction of nature has now reached levels where serious social and economic costs are being felt and will be felt at an accelerating pace if we continue with 'business as usual' [I1-2, N1, B1-2].
- **Recommendations:** Decision makers at all levels should take steps to assess and communicate the role of biodiversity and ecosystem services in economic activity, and for →*human well-being*. Such assessments should include analysis of how the costs and benefits of ecosystem services are spread across different sections of society, across localities, and over time. Public disclosure of and accountability for impacts on nature should be essential outcomes of biodiversity assessment [N1, N3-4, L1, B2-3].

PRICING THE PRICELESS?

- **Conclusions:** Valuing ecosystem services and biodiversity in monetary terms can be complex and controversial [F4-5]. Biodiversity delivers multiple services from local to global levels, while responses to biodiversity loss range from emotional to utilitarian. At the same time, the natural science underpinning many →*economic valuations* remains poorly understood. Nevertheless, both economics

and ethics demand more systematic attention to the values of biodiversity and ecosystem services. Substantial progress has been made in valuation methodology and the process should be uncontroversial for many ecosystem services, especially at the local scale. Further guidance is needed on how, in what context, and for what purpose to use which kind of valuation method, illustrated with quality examples, which are increasingly available [F5, N1, L3, B3].

- **Recommendations:** An ecosystem service perspective should inform economic valuations of biodiversity, focusing on how decision makers can include the benefits and costs of conserving or restoring nature in their considerations. Once the relevant ecosystem services have been identified, the context of the decision will determine which methods and what degree of quantification and monetary valuation is appropriate. Drawing on work by TEEB and others, the standards of valuation representing best practice can increasingly be specified for different contexts and applications [F5, N4, L3].

ACCOUNTING FOR RISK AND UNCERTAINTY

- **Conclusions:** While an ecosystem services approach can help to recognize values and may guide management, it does not explain how ecosystems function. There is mounting evidence of the key role of biodiversity in delivering some – but not all – ecosystem services. Biodiversity also contributes to ecosystem →*resilience* – i.e. their ability to continue providing services under changing environmental conditions. Ecosystem resilience provides a kind of 'natural insurance' against potential shocks and losses of ecosystem services. Although difficult to measure, the insurance value of well-functioning ecosystems should be regarded as integral part of their total economic

value. A precautionary approach to conserving biodiversity can be very effective in maintaining resilient ecosystems, capable of delivering multiple services on a sustainable basis [F2].

- **Recommendations:** →*Economic valuation* is less useful in situations characterized by non-marginal change, →*radical uncertainty* or ignorance about potential →*tipping points*. In such circumstances, prudent policy should invoke complementary approaches such as the ‘safe minimum standard’ or the ‘precautionary principle’ [F5]. Under conditions of uncertainty it is generally advisable to err on the side of caution and conservation [N7, L6].

VALUING THE FUTURE

- **Conclusions:** There is no simple rule for choosing a →*discount rate* to compare present and future costs and benefits. Discount rates reflect our responsibility to future generations and are a matter of ethical choice, our best estimates about technological change and the well-being of people in the future. For example, a 4% discount rate implies that biodiversity loss 50 years from now will be valued at only 1/7 of the same amount of biodiversity loss today. Furthermore, care is needed in the choice of discount rates for different asset classes; reflecting whether they are public or private goods and whether they are manufactured or ecological assets³. A strong case can be made for using lower discount rates for →*public goods* and natural/ecological assets. [I, F6]
- **Recommendations:** A variety of →*discount rates*, including zero and negative rates, may be used depending on the nature of the assets being valued, the time period involved, the degree of uncertainty, and the scope of the project or policy being evaluated. Uncertainty does not necessarily justify a higher discount rate. Different discount rates should be used for different types of assets and services, factoring in their nature as public goods or private assets, and also whether they are capable of being manufactured or not (i.e. social discount rates for public goods and natural assets versus market discount rates for private goods and manufactured assets). Presenting a sensitivity analysis of benefit-cost-ratios using a range of different discount rates is always recommended,

in order to highlight different ethical perspectives and their implications for future generations. [I, F6]

MEASURING BETTER TO MANAGE BETTER

- **Conclusions:** Natural resources are economic assets, whether or not they enter the marketplace. However, conventional measures of national economic performance and wealth, such as GDP and Standard National Accounts, fail to reflect →*natural capital* stocks or flows of ecosystem services, contributing to the economic invisibility of nature [N3].
- **Recommendations:** The present system of national accounts should be rapidly upgraded to include the value of changes in natural capital stocks and ecosystem services. Such a shift could be supported, in part, through amendments to the UN manual on Integrated Environmental and Economic Accounting. Governments should also develop a ‘dashboard’ of indicators to monitor changes to physical, natural, human, and social capital as an ongoing effort [F3, N3]. Moreover, an urgent priority is to draw up consistent physical accounts for forest stocks and ecosystem services, both of which are required, e.g. for the development of new forest carbon mechanisms and →*incentives* [N5].

NATURAL CAPITAL AND POVERTY REDUCTION

- **Conclusions:** Poverty is a complex phenomenon and the relationship between poverty and biodiversity is not always clear-cut. In many countries poor households rely on →*natural capital* for a disproportionately large fraction of their income (e.g. in agriculture, forestry, fisheries) [N3]. Moreover these households have few means to cope with losses of critical ecosystem services, such as drinking water purification or protection from natural hazards. Sustainable management of natural capital is thus a key element to achieving poverty reduction objectives as reflected in the Millennium Development Goals [I2, L1].
- **Recommendations:** Human dependence on ecosystem services and particularly their role as a lifeline for many poor households needs to be more

fully integrated into policy. This applies both to targeting development interventions as well as to evaluating the social impacts of policies that affect the environment. How do policies directly and indirectly influence future availability and distribution of ecosystem services? This is not only a matter of applying appropriate indicators and analytical tools it also requires acting upon these insights [N2,3, L1,10]. In order to secure equitable access and maintain the flow of →*public goods* provided by nature, private, public and common property rights need to be carefully balanced [L10]. Given this, public investment as well as development aid targeted at maintaining or rebuilding →*ecological infrastructure* can make significant contributions to poverty reduction [N9, L5].

BEYOND THE BOTTOM LINE – DISCLOSURE AND COMPENSATION

- **Conclusions:** Better accounting of business impacts and dependence on biodiversity and ecosystem services – direct and indirect, positive and negative – is essential to spur needed change in business investment and operations [B2]. Current accountancy rules, purchasing policies and reporting standards do not consistently require attention to environmental externalities – including social costs due to impacts on ecosystems and biodiversity. Integrating biodiversity and ecosystem services into product value chains can, however, generate significant cost savings and new revenues, as well as improved business reputation and licence to operate [B3-5].
- **Recommendations:** The annual reports and accounts of business and other organizations should disclose all major externalities, including environmental liabilities and changes in natural assets not currently included in the statutory accounts [B3]. Methodologies, metrics and standards for sustainable management and integrated accounting of biodiversity and ecosystem services should be developed as a priority by national and international accounting bodies, working in cooperation with the conservation community and other stakeholders. The principles of ‘No Net Loss’ or ‘Net Positive Impact’ should be considered as normal business practice, using robust biodiversity

performance benchmarks and assurance processes to avoid and mitigate damage, together with pro-biodiversity investment to compensate for adverse impacts that cannot be avoided [B4].

CHANGING THE INCENTIVES

- **Conclusions:** →*Economic incentives* including market prices, taxes, subsidies and other signals play a major role in influencing the use of →*natural capital* [N5-7]. In most countries, these market signals do not take account of the full value of ecosystem services; moreover, some of them unintentionally have negative side effects on natural capital. Reforming and redirecting environmentally harmful subsidies in such areas as fossil fuels, agriculture, fisheries, transport and water could provide significant benefits for nature as well as for government budgets [N6].
- **Recommendations:** The principles of ‘polluter pays’ and ‘full-cost-recovery’ are powerful guidelines for the realignment of →*incentive* structures and fiscal reform. In some contexts, the principle of ‘beneficiary pays’ can be invoked to support new positive incentives such as payments for ecosystem services, tax breaks and other fiscal transfers that aim to encourage private and public sector actors to provide ecosystem services [N5, N7, L8]. Reform of property rights, liability regimes, consumer information and other measures can also stimulate private investment in conservation and sustainable use [N2,7, L9]. As a first step, all governments should aim for full disclosure of subsidies, measuring and reporting them annually in order that their perverse components may be recognized, tracked and eventually phased out [N6].

PROTECTED AREAS OFFER VALUE FOR MONEY

- **Conclusions:** Some 12% of the Earth’s land surface is covered by protected areas; however, marine protected areas are still relatively rare. Moreover, a significant proportion of terrestrial protected areas are not managed effectively. According to a range of studies, the costs of setting up and managing protected areas, including the →*opportunity costs* incurred by foregoing

economic activity, are commonly far outweighed by the value of ecosystem services provided by such areas. However, many of the benefits of protected areas are enjoyed far away or far into the future (e.g. carbon storage), while costs tend to be local and immediate [N8, L7].

- **Recommendations:** The establishment of comprehensive, representative, effective and equitably managed systems of national and regional protected areas should be pursued (especially in the high-seas) in order to conserve biodiversity and maintain a wide range of ecosystem services. Ecosystem → *valuation* can help to justify protected areas policy, identify funding and investment opportunities, and inform conservation priorities. [N8, L7].

ECOLOGICAL INFRASTRUCTURE AND CLIMATE CHANGE

- **Conclusions:** Investing in → *ecological infrastructure* often makes economic sense when the full range of benefits is taken into account. Maintaining, restoring or enhancing services provided by ecosystems, such as mangroves, other wetlands and forest watersheds often compare very favourably with alternative man-made infrastructure, such as wastewater treatment plants or dykes. While it is usually cheaper to avoid degradation than to pay for ecological restoration, there are, nonetheless, many cases in which the benefits from restoring degraded ecosystems far outweigh the costs. Such restoration projects could become increasingly important as a means of adapting to climate change [C, N9, L5]. Likewise, reducing emissions from deforestation and forest degradation (REDD-Plus) represents an important opportunity to limit the scale and impacts of climate change, with a wide range of additional benefits for biodiversity and people [N5].
- **Recommendations:** Ecosystem conservation and restoration should be regarded as a viable investment option in support of a range of policy goals including food security, urban development, water purification and wastewater treatment, regional development, as well as climate change mitigation

and adaptation [N9]. Within the UNFCCC process, REDD-Plus should be prioritized for accelerated implementation, beginning with pilot projects and efforts to strengthen capacity in developing countries to help them establish credible systems of monitoring and verification that will allow for the full deployment of the instrument [C, N5].

MAINSTREAMING THE ECONOMICS OF NATURE

- **Conclusions:** Failure to incorporate the values of ecosystem services and biodiversity into economic decision making has resulted in the perpetuation of investments and activities that degrade → *natural capital*. Including the full value of biodiversity and ecosystem services in decision making can be achieved if their sustainable management is recognized as an economic opportunity rather than as a constraint on development [N2, L1, 10, B5].
- **Recommendations:** Demonstrating the full range of ecosystem service values can help to increase awareness and commitment to sustainable management of biodiversity. Mainstreaming these values requires that → *natural capital* is considered routinely in:
 - economic, trade and development policies, for example by integrating biodiversity and ecosystem services in the impact assessments for new legislation, agreements and investment [N3,4],
 - transport, energy and mining activities, for example by taking account of the value of nature in legislation, infrastructure investments and in permitting, inspection and enforcement [N4, L6, B4],
 - agriculture, fisheries, forestry practices, for example by integrating the value of biodiversity (or the costs of its loss) into reviews and reform of existing policies and instruments [N5-7, L5]
 - corporate strategies and operations, for example in business financial and Corporate-Social-Responsibility management and reporting [B3, B6],
 - development policies and planning at local, regional and national levels [N4, L4-6], and
 - public procurement and private consumption, for example via further developing certification and eco-labelling approaches [N5, L9]

The TEEB study makes the case for significant changes in the way we manage nature, based on economic concepts and tools. It calls for wider recognition of nature's contribution to human livelihoods, health, security, and culture by decision makers at all levels (national and local policy makers, administrators, businesses and citizens). It promotes the demonstration and (where appropriate) the capture of the economic values of nature's services through an array of policy instruments and mechanisms, some of which are market-based.

The issue facing us is how to ensure nature's capacity to continue providing these benefits in the face of widespread pressures. Ignoring biodiversity and persisting with conventional approaches to wealth creation and development is a risky strategy and ultimately self-defeating if it means losing the benefits that biodiversity provides, including most critically to the livelihoods of poor people.

National policy makers, local administrators, businesses and consumers each have an important role to play in responding to the recommendations set out in

the TEEB reports. Taking the steps outlined in TEEB will help ensure that the economics of nature and its valuable services become more visible. By making this transformative journey, a compelling and successful rationale will emerge for the conservation and sustainable use of the living fabric of this planet – its ecosystems, its biodiversity.

Vision: Making Nature Economically Visible

Biodiversity in all its dimensions – the quality, quantity and diversity of ecosystems, species and genes – needs to be preserved not only for societal, ethical or religious reasons but also for the economic benefits it provides to present and future generations. We should aim to become a society that recognizes, measures, manages and economically rewards responsible stewardship of its natural capital.

"Another world is not only possible, she is on her way. On a quiet day, I can hear her breathing"

(Arundhati Roy, author of *The God of Small Things*, at the World Social Forum 2003)



Photographs by NASA and André Künzelmann, UFZ, composition by Susan Walter, UFZ

ENDNOTES

¹ The G8+5 includes the heads of government from the G8 nations (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States), plus the heads of government of five emerging economies (Brazil, China, India, Mexico and South Africa).

² For more information see: <http://bbop.forest-trends.org/> and <http://gdm.earthmind.net>

³ It has long been argued (e.g. Krutilla 1967) that when evaluating trade-offs between natural and man-made assets, it is acceptable to use different discount rates, on the grounds that technological advances may not enable us to 'manufacture' ecosystems and their services, unlike industrial goods.

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ANNEX 1: GLOSSARY

Biodiversity: the variability among living organisms, including terrestrial, marine, and other aquatic ecosystems. Biodiversity includes diversity within species, between species, and between ecosystems.

Biome: a large geographic region, characterized by life forms that develop in response to relatively uniform climatic conditions. Examples are tropical rain forest, savannah, desert, tundra.

Critical natural capital: describes the part of the natural capital that is irreplaceable for the functioning of the ecosystem, and hence for the provision of its services.

Discount rate: a rate used to determine the present value of future benefits.

Direct-use value (of ecosystems): the benefits derived from the services provided by an ecosystem that are used directly by an economic agent. These include consumptive uses (e.g. harvesting goods) and non-consumptive uses (e.g. enjoyment of scenic beauty).

Driver (direct or indirect): any natural or human-induced factor that directly or indirectly causes a change in an ecosystem.

Ecological infrastructure: a concept referring to both services by natural ecosystems (e.g. storm protection by mangroves and coral reefs or water purification by forests and wetlands), and to nature within man-made ecosystems (e.g. microclimate regulation by urban parks).

Ecosystem services: the direct and indirect contributions of ecosystems to human well-being. The concept 'ecosystem goods and services' is synonymous with ecosystem services.

Existence value: the value that individuals place on knowing that a resource exists, even if they never use that resource (also sometimes known as conservation value or passive use value).

Human well-being: concept prominently used in the Millennium Ecosystem Assessment – it describes elements largely agreed to constitute 'a good life', including basic material goods, freedom and choice, health and bodily well-being, good social relations, security, peace of mind, and spiritual experience.

Incentives (disincentives), economic: a material reward (or punishment) in return for acting in a particular way which is beneficial (or harmful) to a set goal.

Indirect-use value (of ecosystems): the benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, the purification of drinking water filtered by soils.

Natural capital: an economic metaphor for the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services.

Non-use value: benefits which do not arise from direct or indirect use.

Opportunity costs: foregone benefits of not using land/ecosystems in a different way, e.g. the potential income from agriculture when conserving a forest.

Public goods: a good or service in which the benefit received by any one party does not diminish the availability of the benefits to others, and where access to the good cannot be restricted.

Radical uncertainty: describes situations where the range of potential consequences of an action is unknown, as opposed to the uncertainty about whether a known (possible) consequence will happen.

Resilience (of ecosystems): their ability to function and provide critical ecosystem services under changing conditions.

Threshold/tipping point: a point or level at which ecosystems change, sometimes irreversibly, to a significantly different state, seriously affecting their capacity to deliver certain ecosystem services.

Total economic value (TEV): a framework for considering various constituents of value, including direct use value, indirect use value, option value, quasi-option value, and existence value.

Trade-offs: a choice that involves losing one quality or service (of an ecosystem) in return for gaining another quality or service. Many decisions affecting ecosystems involve trade-offs, sometimes mainly in the long term.

Valuation, economic: the process of estimating a value for a particular good or service in a certain context in monetary terms.

Willingness-to-pay (WTP): estimate of the amount people are prepared to pay in exchange for a certain state or good for which there is normally no market price (e.g. WTP for protection of an endangered species).

ANNEX 2: WHAT ARE ECOSYSTEM SERVICES

Provisioning Services are ecosystem services that describe the material outputs from ecosystems. They include food, water and other resources.



Food: Ecosystems provide the conditions for growing food – in wild habitats and in managed agro-ecosystems.



Raw materials: Ecosystems provide a great diversity of materials for construction and fuel.



Fresh water: Ecosystems provide surface and groundwater.



Medicinal resources: Many plants are used as traditional medicines and as input for the pharmaceutical industry.

Regulating Services are the services that ecosystems provide by acting as regulators eg regulating the quality of air and soil or by providing flood and disease control.



Local climate and air quality regulation: Trees provide shade and remove pollutants from the atmosphere. Forests influence rainfall.



Carbon sequestration and storage: As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues.



Moderation of extreme events: Ecosystems and living organisms create buffers against natural hazards such as floods, storms, and landslides.



Waste-water treatment: Micro-organisms in soil and in wetlands decompose human and animal waste, as well as many pollutants.



Erosion prevention and maintenance of soil fertility: Soil erosion is a key factor in the process of land degradation and desertification.



Pollination: Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.



Biological control: Ecosystems are important for regulating pests and vector borne diseases.

Habitat or Supporting Services underpin almost all other services. Ecosystems provide living spaces for plants or animals; they also maintain a diversity of different breeds of plants and animals.



Habitats for species: Habitats provide everything that an individual plant or animal needs to survive. Migratory species need habitats along their migrating routes.



Maintenance of genetic diversity: Genetic diversity distinguishes different breeds or races, providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock.

Cultural Services include the non-material benefits people obtain from contact with ecosystems. They include aesthetic, spiritual and psychological benefits.



Recreation and mental and physical health: The role of natural landscapes and urban green space for maintaining mental and physical health is increasingly being recognized.



Tourism: Nature tourism provides considerable economic benefits and is a vital source of income for many countries.



Aesthetic appreciation and inspiration for culture, art and design: Language, knowledge and appreciation of the natural environment have been intimately related throughout human history.



Spiritual experience and sense of place: Nature is a common element of all major religions; natural landscapes also form local identity and sense of belonging.

Icons designed by Jan Sasse for TEEB. They are available for download at www.teebweb.org

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