Global Biodiversity Outlook 4 (GBO-4) Technical Report

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Overview of the Global Biodiversity Outlook 4 Technical Report

Objectives of the GBO-4 Technical Report

In 2010, the Parties to the Convention on Biological Diversity adopted the Strategic Plan for Biodiversity 2011-2020 in Nagoya, Japan. This Strategic Plan includes a "shared vision, a mission, strategic goals and 20 ambitious yet achievable targets, collectively known as the Aichi Targets." The vision is that "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people." The Global Biodiversity Outlook 4 is an assessment of progress towards attaining the Strategic Plan roughly halfway between its adoption in 2010 and the deadline for achieving most of the Aichi Targets in 2020.

This Global Biodiversity Outlook 4 (GBO-4) Technical Report provides a detailed assessment of the evidence base underlying the conclusions in the main Global Biodiversity Outlook 4 report. The Technical Report examines this evidence base with the objective of providing policy-relevant answers to the following questions:

1. Are we currently on a path to meet the Aichi 2020 Targets?
2. What are the consequences of achieving or not achieving the Aichi Targets in terms of key indicators of biodiversity and ecosystem services?
3. What actions would contribute to attaining the Aichi Targets, and what are the costs and benefits of these actions?
4. For which plausible socio-economic development pathways are the 2050 Vision attainable?
5. To what extent would achieving the Aichi Targets help to reach the 2050 Vision?
6. What are the tradeoffs and synergies between the Aichi Targets?
7. What is the contribution of meeting the Aichi Targets and the 2050 Vision with respect to human wellbeing and in particular the Millennium Development Goals and forthcoming Sustainable Development Goals?

The GBO-4 assessment is largely based on research published in peer-reviewed scientific journals, as well as national and international assessments (e.g., IPCC, FAO, National ecosystem assessments). We have also relied on i) national reports[1] and ii) analyses that were carried out specifically for the GBO4 assessment. Where we have relied on unpublished research, we have carefully documented the methodology in publically available appendices.

Our objectives are to provide clear input into policy, open the door to a stronger dialog with stakeholders concerning desirable endpoints, identify actions needed to reach these endpoints and examine a broad range of socio-economic development pathways and their impacts on the environment. To achieve these objectives we have brought together analyses of key indicators of recent trends, current status, near term projections to 2020 and longer-term projections to 2050 for each of the Aichi Targets. For each Aichi Target, we have

[1] This draft of the GBO-4 report includes summaries of national biodiversity strategies and action plans (NBSAPs) that were available when preparing this draft. As such, these summaries should be considered as preliminary. The national reports used in the different chapters are referenced in the corresponding chapter. The final version of the GBO-4 report will account for additional NBSAPs received.

assessed progress towards the target, principal actions that would be required to meet the target, and the costs and benefits of doing so by building on the work of the High Level Panel on Global Assessment of Resources for Implementing the Strategic Plan for Biodiversity. We have also identified key uncertainties and knowledge gaps. In addition, we have examined the interactions between the Aichi targets and used a variety of scenario-based studies to assess how various socio-economic development pathways will lead us away from or towards the CBD 2050 Vision.

As in previous Global Biodiversity Outlooks, we use “biodiversity” in a broad sense as it is defined in the Convention on Biological Diversity; i.e. to mean the abundance and distributions of and interactions between genotypes, species, communities, ecosystems and biomes. This assessment has a strong focus on species as in previous reports, but includes a greater focus on drivers of biodiversity loss and on ecosystems than previous reports due the nature of the issues addressed in the Aichi targets. Genetic diversity is also addressed, but the lack of data and scenarios for genetic diversity has limited the assessment of diversity at this level.

Assessments in this GBO-4 technical report were carried out by a consortium of scientists that responded to a call for proposals by the CBD Secretariat in 2012. Several additional scientists provided expertise in areas lacking within the consortium.

Analysis of status and trends

We have used a wide range of indicators to determine progress towards the Aichi 2020 targets including i) indicators developed by the Biodiversity Indicators Partnership (BIP) and included in their "Aichi Passport" and ii) additional indicators that are pertinent to the Aichi Targets and have sufficient time series to discern statistical temporal trends.

The Biodiversity Indicators Partnership is an international consortium of organizations that was established in 2007 to provide a wide range of indicators that can be used to assess progress towards international biodiversity targets. The Aichi Passport initiative was developed by the BIP to provide an annual update of progress in a form that is widely available to decision makers and the public. The BIP indicators are described in detail at the web site www.bipindicators.net/indicators. The GBO-4 analysis uses many, but not all of the Aichi Passport indicators.

The BIP indicators do not currently cover all of the Aichi Targets. Many of the Aichi Targets also include a number of sub-objectives and coverage of these sub-objectives by the BIP indicators is lacking for some targets. To provide a broader coverage of Targets and sub-objectives, we identified a number of other key indicators that can be used to assess trends and to project these trends to 2020. Our criteria for including these indicators in the GBO4 assessment were: i) a credible source, ii) well described, publically available methods, iii) pertinence to Aichi Targets and iv) a series of at least five data points in time so that statistical analysis could be used to determine temporal trends and extrapolate cautiously to 2020. Most data had a final point post-2010.

For the BIP indicators and other indicators with five or more data points in time we determined trends using statistical fits to the data using a wide range of linear and non-linear models. These models were included in order to fit the range of possible shapes of curves from the time-series. The best-fitting statistical models were determined using a well-known metric that takes into account how well the model fits the data and the number of parameters in the model (Akaike Information Criterion, AIC). This metric is based on the assumption that the best model describes the data reasonably well with a small number of parameters. The best fitting models where then combined to provide a "mean" trend, weighted by their goodness-of-fit, as well as confidence bounds around the estimate of the mean trend. Further descriptions of the methods can be found in Appendices 1 and 2 of chapter 21.

Methods for Future Projections used in GBO-4

For projections to 2020 and 2050, we have taken a much broader approach to scenario analysis than in previous global assessments by complementing "storyline" approaches to socio-economic scenarios (e.g., IPCC SRES scenarios, MA scenarios) with other types scenarios and extrapolations of current trends (see van Vuuren et al., 2012 for a review).

Most global scenarios assessments for biodiversity and ecosystem services have been based on socio-economic storyline approaches (e.g., MA, GEO, IPCC, and previous GBO reports, van Vuuren et al., 2012, Fig. 0.1). These are projections of socio-economic development based on various plausible hypotheses about the future dynamics of key driving forces of global change such as population growth, per capita resource use, etc. In most cases, these scenarios of socio-economic development pathways have been coupled with quantitative models of their impacts on proximate drivers of change in biodiversity and ecosystem services (e.g., land use, fishing pressure, climate change) and models of the impacts of these proximate drivers on biodiversity and ecosystem services (Pereira et al., 2010). These scenarios typically do not explore specific policy options, tend to explore a relatively narrow range of possible futures and focus on time scales of many decades (Leadley et al., 2010, Pereira et al., 2010, van Vuuren et al., 2012). In this report, we have relied heavily on additional approaches to scenarios including extrapolation from current trends in drivers and in dynamics of biodiversity and ecosystem services and a broad range of types of scenarios of socio-economic development pathways.

We have primarily, but not exclusively, relied on four main types of scenarios (van Vuuren et al. 2012, Fig. 0.1):

1. Extrapolations of current trends – statistical extrapolations of current trends are sometimes coupled with simple models of management or policy options. We have limited these extrapolations to the 2020 time period.
2. Socio-economic storylines – plausible socio-economic development scenarios are coupled with models of impacts; e.g., analyses based on MA, GEO, IPCC storylines.
3. Policy options – policy options are added to storylines of "business-as-usual" socio-economic development and then tested for impacts.

4. Backcasting or desirable endpoint analyses – desirable multi-criteria endpoints are set for the future and then plausible scenarios are developed that come as close as possible to reaching these endpoints.

Several other methods for exploring the possible future dynamics of social-ecological systems are widely used at national and sub-national scales including participatory approaches, econometric projections, bio-economic viability analysis, and others. We have not relied heavily on these types of scenarios because the small spatial scale in most of these studies makes it difficult to scale up for a global assessment. More detailed explanations of the socio-economic scenarios used in many of the studies that we examined for this assessment can be found in van Vuuren et al., (2012) and references therein.

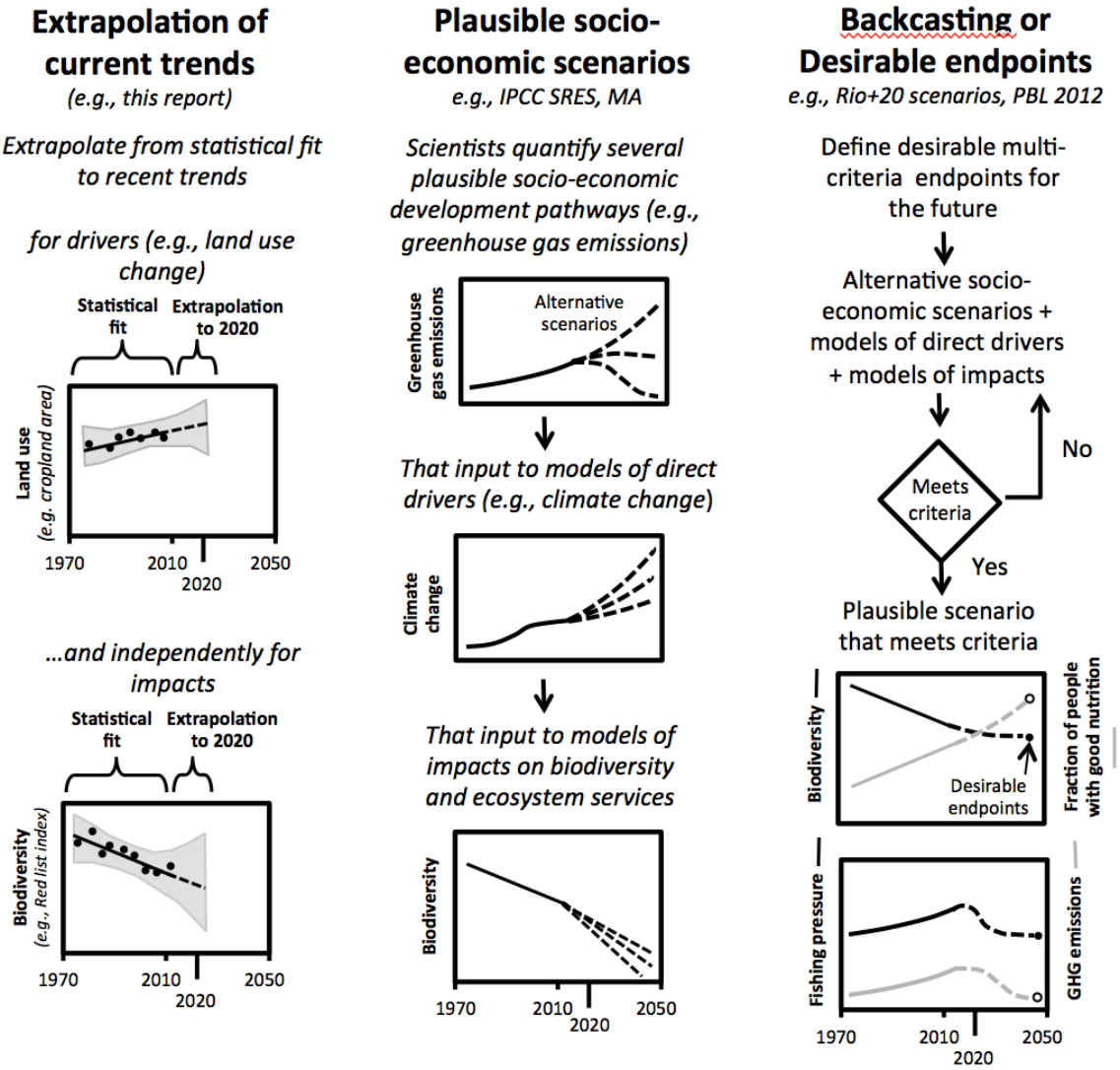

Figure 0.1. Typology of three different types of scenarios used in this report for projecting future trends. Note that policy scenarios (see text) are not shown. These are typically variants of the "plausible socio-economic scenarios" analyzing the impacts of specific policy measures compared to business-as-usual scenarios (i.e., baseline). Current trends are indicated by solid lines and projections by dashed lines. The grey regions around the statistical extrapolations are the statistical confidence bounds around the trend line.

Each of these methods has strengths and weaknesses that are outlined in Table 0.1. As such, we have used a combination of these methods to provide a broad range of insights into plausible future trajectories.

Table 0.1. Strengths and weaknesses of various scenarios approaches.

Model Type	Strengths	Weaknesses	Examples
Statistical Extrapolation	Simple to understand Straightforward analysis requiring very modest computing power Accurately describes current trends	Extrapolation only for short term and with the assumption that underlying processes remain constant Does not identify key drivers; only fits trends Difficult to carry out due to lack of high quality time series for many indicators	Nicolson et al. (2012), Extrapolations in this report (see Appendix 1)
Socio-economic scenarios	Some scenarios are very widely used which facilitates comparison between studies and analysis of uncertainty Limited number of scenarios (typically four) simplifies comparisons across studies Time frame of scenarios typically several decades so useful for exploring long-term dynamics	Most current scenarios focus too heavily on climate change criteria Current scenarios do not include positive outcomes across a wide range of criteria Policy options difficult to extract from scenarios Time frame of scenarios typically several decades	IPCC SRES, Millennium Assessment, Global Environmental Outlook 4
Policy options	Policy options are explicitly accounted for Options more easily understood by stakeholders than complex scenarios	Creates a large number of scenarios to be evaluated Not yet widely used	"Rethinking" analysis (PBL 2010), OECD Second Environment Outlook
Backcasting or Desirable endpoint analysis	Encourages exploration of positive outcomes and pathways of how to achieve desired end-points Opens the door to stakeholders or policy objectives to contribute to defining desirable outcomes Determine short term priorities as consequence of long term (normative) analysis	Few institutions capable of carrying out analysis Large investment in human and computing resources required Not yet widely used	Rio+20 analysis (PBL 2012) Appendix 3

Organization of the report

The Executive Summary provides a summary of the key findings of the report. This summary is more technically oriented than the main GBO-4 report.

Analyses of each of the individual Aichi 2020 Targets are structured to respond to the questions outlined in the *Objectives of the GBO4 Technical Report* section above. The structure of the chapters addressing the individual Aichi 2020 Targets is as follows:

- Preface
- Are we on track to achieve the 2020 target?
  - Status and trends
  - Projecting forward to 2020
- What needs to be done to reach the Aichi Target?
  - Actions
  - Costs and Cost-benefit analysis
- What are the implications for biodiversity in 2020?
- What do scenarios suggest for 2050 and what are the implications for biodiversity?
- Uncertainties and data requirements
- Key indicator summary of progress towards the Aichi Target
- References

Interactions between the Aichi Targets are then evaluated with a specific focus on the strengths of interactions between targets and an analysis of key synergies and trade-offs among targets. We also analyzed how achieving the Aichi Targets can contribute to the longer term goals embodied in the CBD 2050 Vision and to the Sustainable Development Goals that will carry on after the end of the Millennium Development Goals in 2015.

Finally, we provide an overview of the needs in terms of research, data collection and data analysis that will be required to better ascertain the achievement of the Aichi Targets in 2020 and of CBD Strategic Plan over the longer term. Research on monitoring and modeling biodiversity and ecosystem services has developed rapidly over the last few years. This has allowed us to carry out many analyses that were not possible for the previous Global Biodiversity Outlook (GBO-3). However, considerable progress remains to be made and we have only been able to partially fulfill the objective of assessing progress towards the Aichi 2020 Targets and the 2050 Vision.