

Scenarios and models for exploring future trends of biodiversity and ecosystem services changes

(ENV.G.1/ETU/2008/0090r)

Project workshop

The use of quantitative analysis to support political decision making

Extract from the technical description of the Study ENV.G.1/ETU/2008/0090r

1 Background

The Biodiversity Communication (COM(2006)216) places emphasis on the link between biodiversity loss and the decline of ecosystem services and the potential impact on this decline on prosperity and well being. The link between individual choices with regard to various and often simultaneous uses of biodiversity and ecosystems services by different stakeholders-users (the cumulative effect), and the side effect of activity location, notably development, transport and production of services, are crucial issues. The Economics of Ecosystems and Biodiversity interim report (TEEB interim report)¹ recognised the need to account in the second phase of the TEEB study on aspects regarding different uses and utilisation levels of biodiversity that affect the future state of biodiversity and the levels of ecosystem's services provisions. To do so, the second phase of TEEB will look to develop scenarios and models, that will build future visions and projections taking due account of the alternative policies that may create these environments.

Scenarios provide a methodology for exploring alternative future environments in which today's decisions might be played out. Scenarios are necessary for exploring future trends of biodiversity loss and changes in ecosystem services. They are used to analyse the effects of socio-economic trends on pressures on ecosystems functions (state of biodiversity), and the ability of ecosystems to sustain the above goods and services (impacts). There are also possible feedbacks of changes in impacts on the policies (drivers) that are implemented, either driven by environmental concerns or other (food production, energy security, etc); these feedbacks need also to be explored and reintegrated in the scenarios. Scenarios are not predictions; instead, scenarios are an approach to help manage the inherent uncertainties of decisions by examining plausible, internally consistent alternatives of how the future might unfold and comparing the potential consequences of decisions in different future contexts (SEI, n.d.; Verbug et al. 2006). Scenarios may be purely qualitative, or may generate quantitative results through the use of one or more simulation models.

Scenario development has become a popular tool for the assessment of policy options, at scales ranging from national to regional (e.g. Ferreras et al. 2001; Green et al. 2005; Johansson et al.

¹ Available at http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm

2007; Rounsevell et al. 2006; Sandker et al. 2007; Soares-Filho et al. 2006) to global (e.g. House et al. 2002; Kindermann et al. 2006; Msangi et al. 2007; Sathaye et al. 2003; SCB & NEAA 2007) and there is a growing literature on scenario generation and implementation. Recent large-scale scenario exercises likely to be relevant to the present assessment include: ATEAM (for Europe); the global and regional scale the Millennium Ecosystem Assessment; Global Environment Outlook exercises; the International Assessment of Agricultural Knowledge, Science and Technology for Development; the Intergovernmental Panel on Climate Change fourth assessment; World Energy Outlook; and the OECD Outlook series (environment, agriculture, economics).

Three global assessment projects with relevance for biodiversity and ecosystems have been concluded lately; the GEO4, which has a strong environment focus; the IAASTD, which has a strong focus on knowledge development and transfer and includes fisheries from a capture and aquaculture perspective; and the GLOBIO project (applied in the OECD Environmental Outlook 2008 study) which is exploring global changes in biodiversity. All three assessments are using scenarios. GEO4 is based on scenarios developed from GEO3 (UNEP, 2002) with weightings for optimization based on input from regional representatives of the GEO4 process. The IAASTD and OECD/GLOBIO are using variations around a baseline which is not necessarily a business as usual scenario, but using current trends that are modified by key drivers such as subsidies.

The development of scenarios for the second phase of TEEB is crucial: defining scenarios that are meaningful for the various ecosystem services is a necessary step in assessing ecosystem benefits and the cost of their loss, both in biophysical and in monetary terms. The need for developing and using scenarios has been discussed during an expert workshop hosted in Brussels in March 2008². During this workshop, the following issues have been identified as of particular importance and meriting study during the Phase II of TEEB:

- Run scenarios on sustainable ecosystem use (major & minor users)
- The absence of feedback loops between loss of biodiversity / ecosystems and economic growth in models is unrealistic and undermines the credibility of results. Need to find ways of including feedbacks between supply of natural resources and economic growth in the modelling.
- Pay particular attention to quantifying trade-offs between provisioning and regulating services.
- Although some work exists, an inventory of all major ecosystems should be drawn up and the loss of services expected under different scenarios should be prepared.
- Develop maps of best conservation opportunities available.

In any quantification of the economic consequences of biodiversity loss and ecosystem degradation, in principle at least two scenarios should be compared. These need to be identical in everything else but a specific policy package being tested. Otherwise, the economic results cannot be directly attributed to a difference in biodiversity/ecosystems. For example, an appropriate contrast would be between the state of the world by 2025 generated by a business-as-usual (BAU) scenario, and an alternative state of the world generated by an otherwise identical scenario that includes the policy option of “a comprehensive global network of marine protected areas”. These two scenarios could be contrasted to evaluate the specific economic consequences (both the costs

² The proceedings of the workshop is available at:

http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/workshop_proceedings.pdf

and the benefits) of implementing the marine protected area network, as everything else (e.g., population, technology, consumption) would be the same. Although in this example there are 2 scenarios, plenty more can and should be generated to assess policy packages that address distinct different options for action.

2 Aims of the workshop:

The aim of the present study is threefold:

- to review the different scenarios and models used to explore future trends of biodiversity loss and ecosystem change and the impacts on the ecosystem services they provide;
- to review how these models have factored in policy action, notably environmental and conservation policies;
- to propose a set of options for suitable models and scenarios to be used in a global assessment and discuss them in a workshop.

3 Content / description of the tasks

Task 1: Identification and overview of available models

The study should provide an overview of the models that have been built to identify the main drivers of the loss of biodiversity and natural ecosystems and forecast their impact on:

- the level of biodiversity (in biophysical or other terms); or
- the level of ecosystem services provided

The term 'model' should be interpreted widely, and should cover also the scenarios which the models are deploying, where these are considered to offer some robust assessment of future trends.

In identifying models, the following points are relevant

- a. The overview should mainly focus on models used for large-scale or global assessments. However, it should also cover, in a more selective way, models used at different spatial levels (local, biome, etc.). So, where there are a number of local models then the identification should limit itself to providing a few examples and a generic description. It should be explained how global models take account of and relate to models that address specific biomes (i.e. forests, fisheries) or that are exploring a more detailed spatial level (i.e. if they are bottom-up, aggregated versions, etc). Of course, within global models there will usually be some regional breakdown that needs to be reflected.
- b. The overview should include the attempts made to assess the wider economic impacts of the loss of biodiversity and ecosystems (e.g. with CGE models).
- c. The overview should aim at covering all main types of biomes and ecosystems (terrestrial, freshwater and marine).
- d. The overview should take on board the work produced for the preparation of the Interim report of TEEB and in particular the COPI and Scoping the Science studies. The final reports of both studies can be accessed at:

http://ec.europa.eu/environment/nature/biodiversity/economics/teeb_en.htm,

while the Interim report of TEEB is available at:

http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm

- e. Of particular interest is the provision of ecosystem services. Modelling the provision of services is generally less advanced than modelling the status of biodiversity and ecosystems, so that available models are expected to be fewer, but the overview should cover recent and on-going developments.
- f. The overview should also examine whether there are models that assess the economic costs of policies, including the opportunity costs of conservation. This can cover models that look at the economic value of ecosystems in a static sense (so, for example, there are analyses setting out the net present value of alternative land management systems for tropical forest biomes).
- g. Attention should be paid to analysing the conditions required for designing scenarios and models that are relevant for each ecosystem service (e.g. what is the spatial resolution needed, what major factors need to be taken into account, etc).
- h. As far as is possible, the inventory should include a forward look i.e. address on-going model developments (models that could be expected to be operational in one-two years time).
- i. It should be examined to what extent the costs and benefits of policies can be jointly assessed.

The study should develop a number of criteria for making a structured inventory of the main models. This should include an overview of the strengths and weaknesses of these models (and the data available for such modelling). It should also include an overview of the key drivers and assumptions involved in such models and their respective scenarios.

Task 2: Overview of results from models for the loss of biodiversity and ecosystems and their services

The study should provide an assessment of the main findings from the models identified as part of Task 1. This should include an analysis of the impacts of current and future pressures on biodiversity and ecosystems and their services at the global level and the impact of policies to reduce such losses.

Task 3: Assessment of impact of key assumptions

The assessment should examine how changes in key assumptions affect the results of different models with a focus on either the impact on ecosystem services or on the economy more generally. This should be done through the identification of a number of key assumptions (or drivers) with the Commission and then an examination of how these influence the models (generally involving identification of a baseline and then of an alternative scenario).

Amongst the assumptions to be examined should be a selection of exogenous factors (like population growth, demand for natural resources and energy, etc) and of policies affecting biodiversity and ecosystems, such as agricultural or fisheries management decisions, timber logging/deforestation, or strict conservation³.

The choice of the key assumptions and models to be examined should be determined during the carrying out of the previous tasks, and agreed with the Commission.

³ Of particular interest would be cases involving ecosystem services that have a significant contribution to human welfare but where decisions are made based on other economic benefits (e.g. from other economic activities that have unintended impacts on ecosystems, or from ecosystem management aiming at maximizing certain provisioning services while ignoring regulating services).

The strengths and weaknesses of such analyses should be identified. This should be done with a consideration of the extent to which they could be used for making large-scale assessments of the impacts of the loss of biodiversity and ecosystem services worldwide. It should also consider how such models could be adapted to better assess policies (including coupling of biophysical models with economic models to assess the wider effects on the economy).

3.4. Task 4 - Workshop

On the basis of the above, a small one-day expert workshop, expected to be attended by up to 30 participants, will be hosted. The following issues will be discussed there:

- the modelling approaches currently available
- how these can be used to model policies
- how models and their respective scenarios could be further developed

It is expected that the interim report comprising the results of Task 1 and work related to Tasks 2 and 3 completed at this time will be addressed and discussed during the workshop.