Biodiversity and Industry

Report of an electronic conference, October 2008

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The publication should be cited as follows:
Grant, F., Weber, J., Atramentowicz, M., Hernandez, S., Frascaria-Lacoste, N., Houdet, J., and Watt, A.D. (Eds.). 2008. Biodiversity and Industry. Report of an e-conference.

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Preface

Research on biodiversity is essential to help the European Union and EU Member States to implement the Convention on Biological Diversity as well as reach the target of halting the loss of biodiversity in Europe by 2010.

The need for co-ordination between researchers, the policy-makers that need research results and the organisations that fund research is reflected in the aims of the "European Platform for Biodiversity Research Strategy" (EPBRS), a forum of scientists and policy makers representing the EU countries, whose aims are to promote discussion of EU biodiversity research strategies and priorities, to exchange information on national biodiversity activities and to disseminate current best practices and information regarding the scientific understanding of biodiversity conservation.

This is a report of the E-Conference entitled "Biodiversity and Industry" preceding the EPBRS meeting to be held under the French EU presidency in Paris, France, from the 17th to the 21st of November 2008.

Introduction

Jacques Weber

The Millennium Ecosystem Assessment (MEA) observed in 2005 that: "Many businesses will experience an array of direct and indirect impacts immediately because ecosystem degradation is changing public policy, consumer preferences, supplier relationships, stockholder expectations, and competitor strategies (...)" The MEA also noticed that things are rapidly changing: "For companies in the investment portfolios of leading fund managers and other institutional investors, it is increasingly common to be assessed for company risk on a whole range of issues, including biodiversity management and other ecosystem services."

The Economics of Ecosystems and Biodiversity (TEEB) group, chaired by Pavan Sukdhev, produced a draft report on the cost of policy inaction, showing that Industry is to lose some 1300 billion Euros each year in 2050. Many institutions have understood that the time for action has come. The CBD Business and Biodiversity Initiative, and the TEEB report, are among a growing number of initiatives aiming at a more careful approach to the interactions between industrial activities and the living world, i.e. biodiversity.

Industry relies on biodiversity for a large part of its raw materials, and its technologies ("issued from life"), notably fermentations and medicines. Even fossil energy is a leg from biodiversity of the past.

This e-conference is important in order to prepare for two events to be held on November the 17th-21st:

1. The EPBRS meeting in Paris under the French Presidency of the EU
2. A symposium to be held on November the 18th: "Biodiversity and Industry: Scientists and Managers debate".

This e-conference is organized into 3 sessions:

- Session I: Biodiversity and Industry: Impact evaluation and compensation mechanisms. Chaired by Sarah Hernandez, Economist, from the French Ministry of Environment (MEEDDAT)

- Session II: Biodiversity and Industry: What ecological engineering is needed? Chaired by Nathalie Frascaria, Ecologist, Professor at the University of Paris-Orsay

- Session III: Biodiverity and Industry: How to integrate biodiversity in company strategies; experiences and best practices. Chaired by Joel Houdet, Biodiversity advisor at Orée – Entreprises, Territoires et Environnement

The e-conference welcomes scientists and people from industry and NGOs. We hope to get a broad and deep exchange between different cultures and backgrounds on a question which is of importance for the whole of society.

Summary of contributions

Session I: Impact assessments and compensation mechanisms

Fiona Grant and Allan Watt

In his introduction to the EPBRS e-conference, Jacques Weber set out the main aims of the e-conference, namely to have a broad discussion between scientists and people from industry and NGOs on the need for a more careful approach to the interactions between industrial activities and the living world. This first week of the e-conference focussed on the session entitled 'Impact evaluation and compensation mechanisms'.

Sarah Hernandez introduced this session by encouraging discussion on the use of compensation mechanisms to offset transforming ecosystems into a more human-made environment. She also highlighted the need to remember that the complexity of biodiversity issues goes beyond ecological considerations. In response to this introduction, Cornelia Nauen outlined the need to consider resource externalities that affect biodiversity, ecosystems and habitats. She also called for a targeted effort to be made to make the content of occurrence records, collections and past publications systematically available in order to avoid the shifting baseline syndrome.

The development of methodological tools in order to aid our understanding of ecosystem services and functions was raised by Pauline Teillac-Deschamps and Denis Couvet. They argued that in order to gain a better understanding of these processes it was necessary to develop more robust compensation schemes. They also outlined the use of a Biodiversity Observation Network as a useful tool to help with the quantification of ecosystem functions. Another methodological tool was reviewed by Ece Ozdemiroglu who discussed the use of resource equivalency methods in enabling assessment of environmental impacts and remediation options.

There was much discussion on the topic of valuing ecosystem goods and services. Mac Callaway outlined the need to distinguish between different types of values and the appropriate related modalities of valuation. This point was emphasised further by Katharine Farrell, who highlighted the difficulties involved in generating empirically correct estimates due to the heterogeneity of ecosystems. Martin Sharman outlined the complexity involved when valuing biodiversity and ecosystem services that are not directly used in trade. In response, Mac Callaway argued that it is also difficult to value ecosystem services used directly in trade, due to the difficulty of characterizing

the physical transformations that these goods undergo before they affect the market.

Riccardo Simonicini called for commodities and non-commodities to be valued in both monetary terms and in some sort of unit of energy. He argued that this double pricing system of ecosystem goods and services might also help provide more evidence for the observed links between climate change and biodiversity loss. Joël Houdet agreed with Riccardo Simonicini that there is a need for more than just monetary indicators to assess the ecosystemic performance of organisations, goods and services, but argued that we shouldn't then adopt another arbitrary reductionist proxy to replace this with as biodiversity refers to the dynamics of interactions between organisms in changing environments, as Katharine Farrell had previously mentioned. Controversially Rasmus Ejrnaes argued for scientists to stop relying on the need to communicate the notion of ecosystem benefits and services to decision makers, but instead proposed that we remind politicians of the importance and value of the apparent uselessness of biodiversity.

Christian Béranger's contribution provided an insight into industry initiatives, in particular the quarry industry, to implement biodiversity studies in order to help minimise the impact of industry on biodiversity loss. He also outlined a multidisciplinary programme that has been instigated in order to help identify ecosystem services and their economic value. This programme will provide an estimate of the limitations of economic tools currently available, and the need for improvement or re-allocation of tools towards a new eco-taxation.

Jan Jansen discussed his experience of businesses and biodiversity working together in two different environmental planning areas: urban and Natura 2000. He referred to Sonae Sierra as an example of a business working together with biodiversity in an urban environment. He went on to describe his own experience of advising on a planning project set in Natura 2000 areas and the potential benefits that business involvement can have on restoring habitats and biodiversity.

Stanislav Shmelev discussed the role of social indicators. He summarized the role of multi-criteria decision aid tools in the evaluation of biodiversity to enable simultaneous consideration of a wide spectrum of different dimensions of sustainability.

Voluntary offsets were discussed by Stefan van der Esch. He argued for the need to incorporate current offset initiatives into a production chain perspective to account for

environmental pressures that cross borders due to international trade and in order for global benefits of conservation efforts to be obtained. He went on to illustrate practical approaches to highlight the many factors which need to be taken into account when assessing offsets. Similarly Cornelia Nauen, concentrated her contribution at the global level, highlighting the difficulties involved in implementing environmental impact assessments for global companies. She emphasized the problems incurred due to the financial power of these multinational companies.

The issue of compensation for biodiversity loss was also raised by Cornelia Nauen. She questioned whether or not it was possible for biodiversity loss to ever be compensated and mentioned the UNEP experience of trying to instigate a penal law for pollution misconduct, as so many effects of pollution are irreversible and not subject to compensation.

Session II: What ecological engineering is needed?

Nathalie Frascaria-Lacoste, Fiona Grant and Allan Watt

The second session of the e-conference focussed on 'What ecological engineering is needed?' This session was introduced by Nathalie Frascaria-Lacoste, who stated that ecological engineering is a new field with its roots in the science of ecology. It can be viewed as designing or restoring ecosystems according to ecological principles. She set out the main aims of this session, namely to encourage discussion around two key questions:

- What future is there for ecological engineering in the context of biodiversity and industry?
- How can we combine research and practices within societal constraints?

This session began with some discussion on the role of ecological engineering and environmental management. Patricia Genet highlighted the fact that ecological engineering is a young discipline that can play an important role in designing sustainable environmental management practices. Alain Bédécarrats's contribution argued that future developments will need investments in fundamental and applied research, in education of skilled professionals, in knowledge transfers and in organization of professional networks. He argued that the task is huge and expensive. In addition, something that could be called "a value of nature" is emerging from implementation processes of these strategies. Indeed, because society's environmental awareness is increasing, taking care of nature becomes a competitive factor for firms. Moreover, taking part in the management of biodiversity at a territorial scale also

requires contributing to the management of nature as a public good for the benefit of the territory. From an economic prospect, some kind of specific wealth is certainly created.

There was much discussion on integrating ecological engineering into firms and industries. Regis Maubrey argued that ecological engineering represents a shift in perspective (and thinking) regarding "engineering" itself, as well as regarding "landscapes" and management of territories. The main hypothesis here is that it may in fact be harder to bring about this shift within the public sector than in the private sector (referring still to "firms and industries"). Indeed, on this topic, thinking within a company can evolve faster than that of a community or town, because a company's culture generally will examine the economic advantage of different projects and activities, such as a greater dependence on ecological services.

However, as an answer, Manuel Blouin highlighted that it appears that not all activity sectors are equally amenable to ecological engineering. A major challenge in the development of ecological engineering in private enterprises is to define in which activity sector(s) a real potential exists. Technological aspects have to be taken into account: are science and techniques developed enough? Economic aspects would often be a useful argument, given the increasing price of non-renewable energy, but have to be precisely evaluated, with the integration of "externalities". Social aspects are also important: are people ready to adopt a sustainable development attitude? In response to this, Joel Houdet questioned if it would be possible to use the diversity of living organisms and their interactions as an alternative to production models that rely on homogenous habitats. He continued to explore the possible implications of adopting this strategy.

Freddy Rey outlined a case study of the rehabilitation of eroded mountainous catchments in France. He argued that certain countries have significant financial means and are therefore able to implement optimal restoration actions. They are able to achieve true restoration, with the goal of recovering the original ecosystem that had been damaged. Other countries experience more restrictive situations and aim at financial and energy savings, seeking to minimize interventions: this is called minimal management. He argued that it is necessary for practitioners and ecological engineers to work together and share their expertise in order for rehabilitation to work. Similarly, Robbert Snep argued that the gap between theory and practice in ecological engineering could be bridged as long as both parties are willing to be flexible and keep in mind each others' objectives.

Frédéric Gosselin discussed the idea that industries and the engineers working for them should be more considerate towards humanity and the living world. Furthermore, he mentioned that associated with the eco-responsibility of industries and engineers, there is a need for a firmer ethical grounding for ecological engineers, which could be included in their training.

In a very provocative contribution, Sebastien Barot considered whether greater biodiversity was always better. He questioned whether it always leads to higher sustainability, higher primary production or higher stability in ecosystems. He went on to highlight the potential profits to be gained from investigating the functional consequence of genetic diversity within populations and the use of this in ecological engineering to increase crop yield. In response to this contribution, Jari Lyytimaki provided an alternative perspective on the role of biodiversity as a producer of ecosystem disservices. He argued that ecological engineering should focus on biodiversity as both a provider of ecosystem services and disservices.

In conclusion, what clearly appeared in each contribution as a real challenge, is that in the future, ecologists, engineers, economists, social scientists, practitioners, and decision makers, all have to combine their efforts to communicate (i.e. use the same language) and to interact (i.e. link ecological research and applied research). This should allow the development of new technologies which will change our way of thinking and acting.

Session III: How to integrate biodiversity in company strategies; experiences and best practices

Joel Houdet, Fiona Grant and Allan Watt

The last week of the e-conference focussed on 'How to integrate biodiversity in company strategies; experiences and best practices.' This session was introduced by Joël Houdet who highlighted the international drive towards engaging business for biodiversity and ecosystem services as well as the wide variety of issues involved, ranging from impact mitigation to controversial emerging markets (agro-fuels). He raised the following questions:

- Through case studies and best practices, what can be learned for thorough integration of biodiversity into business strategies?
- What implications are there for decision-making, operations management and annual corporate social responsibility (CSR) reporting?

- What conceptual and practical tools should be developed, promoted and shared by all stakeholders?

Through the work undertaken to conserve biodiversity at the drinking water production site at Crépieux-Charmy (Grand Lyon), Mathieu Tolian underlined the importance of biodiversity for Veolia Environnement. The company depends on the living world to perform its business activities (using biological processes to treat polluted water or organic waste). In addition, these may have secondary impacts related to the residual pollution contained in discharge, so that the company needs to draw upon ecosystem functions and services as in the case of the Crépieux-Charmy catchment area. All of this leads to rethinking its strategies, reflecting on the evolution of their core business towards the integrated management of industrial facilities and the ecosystems of which they are a part. To this end, he stressed the need for expertise in terms of (a) ecosystem management and (b) ecosystem modelling.

With respect to that latter point, Eeva Primmer drew attention to the competencies and resources that organizations (in the extractive sector) rely on to integrate biodiversity conservation into their daily operations (farming, forestry, fisheries, mining). Comparisons within and across industries have been carried out in Finland, especially for the forestry industry.

In the case of Séché Environment, Daniel Baumgarten underscored the importance of biodiversity for the company's corporate culture and strategy. On the ground, much work has been done to integrate its waste storage plants within the surrounding landscape: an overall master landscape plan ensures that important areas for biodiversity are conserved and/or restored. To that end, ecological engineering goes in hand with close cooperation with NGOs and research organisations for long-term biodiversity monitoring programmes, with a special focus on birds.

Nicolas Bertrand provided some clues to what is needed to go beyond individual examples:

1. The business case for biodiversity needs to be further promoted. It is often difficult for the business community to relate to the way the biodiversity challenge is framed. There is a need to "speak a common language".
2. We must get small companies (SMEs) on board, since they make up the majority of businesses worldwide. Most of the business and biodiversity 'toolkit' is currently geared at larger companies.
3. Expanding the business and biodiversity landscape. The business and biodiversity

community would benefit from inviting actors from sectors, markets and regions which have been typically underrepresented to join the discussions. In this regard, a far greater role could be envisaged from business schools and professional services firms.

Martin Sharman argued that it is not just about the integration of biodiversity into businesses, but it is of paramount importance for businesses to 'do good' to the living world, where 'good' is a rather complex and knotty concept. Joël Houdet then asked whether or not voluntary measures by businesses would be sufficient to ensure the viability of biodiversity. He argued that the crunch of the debate has to do with the way we measure the ecosystemic performance of organisations, goods and services. Volker Mauerhofer highlighted the need to split the business case for biodiversity into two distinct situations: 'win-win' situations, when companies directly depend on biodiversity, and 'problematic' situations, when there is a conflict of interest between the short-term economic gain of a business and the long-term interests of sustaining biodiversity.

Drawing upon his experiences in Russia, Vladimir Vershinin stressed the need for effective economic and administrative mechanisms to "push" business into the necessary channels for effective initiatives in the field of biodiversity conservation. Further contributions by Marina Pereira Silva and Isabel Sousa Pinto (Portugal), Peter Petoik (Czech Republic), Anna Budriene and Eduardas Budrys (Lithuania), Simona Mihailescu (Romania) and Viktor Gasso (Ukraine) provided insight into specific countries stances on the business and biodiversity initiative.

Claire Tutenuit proposed that biodiversity valuation be the next step to help companies integrate the diversity of life into decision-making. It could help companies to assess their return on their investments for efforts bearing on biodiversity. Using a common (monetary) indicator might give clearer information and help in defining priorities. But this is not an easy task and although a lot of work has already been done, research in this area still has to be fostered.

Dominique Proy stated that Claire Tutenuit's contribution is particularly relevant to Eurostat, which tries to measure biodiversity by defining some quantitative indicators. With respect to engaging SMEs, Vineta Goba, argued for improved technical assistance for project identification and preparation, the setting up of specific biodiversity-oriented funding facilities, the verification of biodiversity benefits of investment projects, as well as increased sharing of information and capacity building

at all levels.

Improved technical assistance is also a major issue for Edouard Forestié. He highlighted the need for practical and easy-to-use tools for integrating biodiversity into farm management. Farmers depend on biodiversity for agricultural production and carry out various practices to favour biodiversity on their farms (e.g. restore hedges, contract bee keepers) and are very concerned with the evolution of agro-systems on which they depend, shape and belong.

Rik Kutsch Lojenga stressed the need for industry-wide tools, with a focus on the personal care and cosmetics industry. Driven by consumer interest in novel, natural, organic and fair trade products and cautious because of public scrutiny of cases of possible misappropriation of traditional knowledge or genetic resources, companies are actively turning towards ethical sourcing practices. He argued that businesses, at all stages of the production chain, will need to have a management system in place to take into account CBD provisions in their R&D activities and/or biodiversity considerations in their purchasing decisions. To that end, work is currently being undertaken by the Union for Ethical BioTrade. Joel Houdet agreed that addressing biodiversity issues throughout the supply chain is a major, but vital, challenge. From a similar perspective, Yann Maubras and Hélène Leriche presented ongoing work carried out to take into account the impact of food consumption on biodiversity. Their contribution outlines the idea of using an informative labelling system for food products, that is, eco-labelling with a "biodiversity foot-print".

Carsten Nesshover and the TEEB Scientific Coordination Team outlined the interim report of the Economics of Ecosystems and Biodiversity (TEEB) Initiative. The report raised the attention on the urgency of mainstreaming the economics of ecosystems and biodiversity to safeguard them and ensure their sustainable use. They also provided information regarding the end-user reports, targeting policy-makers, local administrators, businesses and consumers to be published in late 2009.

So to conclude, keynotes have demonstrated throughout this session how individual businesses throughout the world are making great efforts for biodiversity. The key challenge now is to put biodiversity on the agenda of every single business, big or small. How can businesses go beyond marketing opportunities that arise from best practices with respect to biodiversity (because the resulting niche markets may not last)? Do we need industry-wide voluntary instruments or standards, new market mechanisms, new regulations or mandatory standards, "Biodiversity foot-print" labels

on every product sold? Perhaps we need a mix of approaches.

In response to the global financial and economic crisis which is currently unfolding, we risk seeing a new "Bretton Woods" founded on (old) economic models that would further homogenise biodiversity, so that "economic" growth resumes. Though risk-free in the short-term for global finance, which can play with risk mitigation tools, the socio-ecological consequences will most likely be irreversible for future generations: i.e. the ones who will work, save money for their retirement and children, loan money to do business, and invest, all in close relationship with financial institutions.

We must make sure that this will not happen: this crisis is a major opportunity for the integration of the economy into biodiversity. During the EPBRS meeting in Paris in November let us put forward a clear message to business leaders and policy-makers.

Research priorities

Fiona Grant and Allan Watt

1. **Research needed to improve impact evaluation**

General:

- Make the content of occurrence records, collections and past publications systematically available
- Integrate in-situ and remote global observation systems
- Coordinate gathered data and the delivery of biodiversity change information
- Gather observations, models, assessments and forecasts
- Build robust and global indicators in order to gather all the information needed for assessment and creation of databases
- Integrate biodiversity values into different land use processes, such as agriculture and forestry
- Carry out impact assessments in a collective/network fashion, rather than site by site

International companies:

- Account for both environmental pressures exported across borders through international trade and for the global benefit of conservation efforts by using a production chain perspective

Aggregate extraction industry:

- Study the statutory framework in order for plans of the whole state to remain consistent, such as access to sites and protection of the surrounding land

2. **Research needed to improve compensation mechanisms**

General:

- Integrate ecosystem functions into compensation schemes
- Ascertain what level of compensation is appropriate for biodiversity evaluation schemes, taking into account that more compensation leads to weaker sustainability and less compensation leads to greater sustainability

Resource Equivalency Methods:

- Improve knowledge of baseline conditions (pre-damage) and how uncertainty about baselines can be incorporated into equivalency analysis
- Improve protocols on estimating recovery rates of a degraded resource
- Investigate the advantages and disadvantages of using different metrics in equivalency analysis
- Improve scientific understanding of damage and remediation and the use

economic value as a metric

3. **Research needed to improve valuation of ecosystem services**

- Distinguish between different types of value and appropriate related modalities of valuation of ecosystem services
- Analyse the 'process fund' and incorporate this into the general discussion of ecosystem services valuations
- Investigate methods to assess ecosystemic performance of organisations, goods and services without the exclusive use of monetary indicators, such as emergy accounting
- Develop pluridisciplinary and interdisciplinary approaches to understand biological mechanisms underlying ecosystem services in order to accurately value these services
- Develop methods to value rare and endangered species and their environmental condition using 'wild values' to represent their scarcity value

4. **Research needed to improve the use of ecological engineering:**

<u>General:</u>

- Research functional consequences of genetic diversity within populations
- Increase knowledge of the functional importance of genetic diversity within and between functional groups
- Develop an integrative approach, using ecological engineering, to articulate companies' environmental strategies with ecosystem services and functioning at special and temporal scales
- Develop a common language to allow ecologists, engineers and economists to work together
- Identify how biodiversity can be a provider of both ecosystem services and disservices
- Research what ecological engineering can offer business sites to help them contribute to their neighbouring biodiversity and landscape value
- Integrate the concepts of adaptation and maladaptation into ecological engineering
- Set standards for methods and operational techniques, and their performance

<u>Integration of ecological engineering into companies:</u>

- Link ecological research and applied research
- Integrate ecological engineering into industry as a logistical tool to help companies reduce their impact on the environment
- Integrate ecological engineering into industry as an assessment tool, to

evaluate the impact of human activity on the environment
- Integrate ecological engineering into consultation agencies
- Identify in which activity sectors there is a real potential for ecological engineering to be used
- Develop ways to make the integration of ecological engineering profitable for businesses
- Examine the hypothesis that private companies will support local biodiversity and ecological engineering more easily than public companies, with more multi-disciplinary research involving both laboratories working on natural systems as well as sociologists, economists and management experts working on private sector issues
- Include the identification of inventories in National Reviews such as those required for quality approaches, especially for environmental quality and performance certification

Rehabilitation of eroded mountainous catchments:

- Increase knowledge of the interactions between vegetation, erosion and sediment dynamics

5. Research needed to integrate biodiversity into businesses

General:

- Develop ecosystem models in order to aid companies to better understand ecosystem complexity and to anticipate the changes ecosystems will undergo as a result of their actions
- Research how to use biodiversity sustainably to make money, while not inadvertently running down other elements of biodiversity through an unintended side-effect
- Develop co-viability models of business and biodiversity, such as a bio-economic model which provides a dynamic and viable approach to ecosystem management
- Develop accounting and fiscal instruments suited to the viability constraints of businesses for promoting the viability of biodiversity
- Assess how much it would cost to make biodiversity a management/innovation/production standard for businesses when producing goods and services
- Introduce control and funding mechanisms to regulate markets for (ecosystem) provisioning services in order to minimize the risk of squandering, excessive exploitation and over-investment
- Integrate the outcomes of long term monitoring into companies' management

frameworks

Finance:

- Evaluate the costs and opportunity costs of conservation policies versus the costs of 'business as usual' within an existing policy network that cause ongoing losses of ecosystems and biodiversity

Food:

- Create new indicators and/or adapt existing indicators which measure the impacts of food consumption and food chain activities on evolution and management of biodiversity
- Identify the ways in which citizens make their decisions regarding food choice
- Identify citizens' perception of biodiversity and efficient educational methods to communicate with them on issues related to biodiversity
- Create an informative labelling of proposed consumer goods giving the measure of their 'biodiversity foot-print' and its declination onto labels

SMEs:

- Integrate biodiversity conservation into SME strategies

Agriculture:

- Develop an easy to use indicator for farmers to estimate their impacts on biodiversity

Factors that need to be considered in order to carry out the research for these research priorities:

General:

- Strong communication between ecologists, engineers, economists, social scientists, practitioners and decision makers
- The ability to switch from theoretical concepts to real-life situations
- Increased public awareness of biodiversity and its implications
- Expand the business and biodiversity landscape by inviting actors from sectors, markets and regions which have been typically underrepresented to join in discussions
- Anticipation and long-term commitment as a key to maintaining a positive and sustainable impact on the natural environment
- Enterprises working closer within the more limited space of local, regional and national communities
- Impact assessments across national borders
- A national or European network to work on solutions for complex socio-economic, ecological, political and juridical problems, which will facilitate

cooperation at a local scale delivering cost-effective ‘made to measure’ solutions to specific local variants of complex ecological problems

- Compensation schemes which span across national borders
- Address biodiversity issues throughout the supply chain of companies

Ecological engineering:

- Firmer ethical ground for ecological engineers, which could be included in their training
- Pragmatic approaches and common sense for addressing knowledge in an engineering context
- Scientists and engineers working together
- Establish a task force made up of ecological engineers which is able to implement appropriate actions and operational solutions in support of biodiversity conservation
- Engage new operators to develop ecological engineering and multidisciplinary professionals to structure the profession

List of contributions

Session I: Impact assessment and compensation mechanisms

Session I Introduction: Impact assessments and compensation mechanisms

Sarah Hernandez, Environmental Economics, Ministry of Ecology, Energy, Sustainable Development and Land Planning, France

N.B. The views expressed in this introduction are the responsibility of the author and do not reflect the views of the Ministry of Ecology.

The role of industry in the conservation and sustainable use of biodiversity and its ecological services is essential to break down the expanding path of its extinction and loss. But to what extent should business responsibility address the broad dimension of problems and issues related to biodiversity degradation? One may expect industry to take care of impacts made on the environment and in particular on biodiversity. The internalisation of costs is not a new concept in environmental economics; neither are the derived regulatory, command and control and/or economic instruments which have been largely used to respond to this policy. Compensation mechanisms, which in some countries have become a market/financial tool, are the way to offset transforming ecosystems into a more human-made environment.

Technically, compensation mechanisms are based on ecological criteria and measurements. Most of the requirements are related to equivalency between damage and offset, the extension and temporality of business liability are decided case by case and country by country. But the evidence is that there is no one formulation for offset measures that fits to all situations of ecological degradation. However, there is a need for business to clarify what to measure, how to do it and which (biological/ecological) standard offset values should be established. In that sense, the debate turns into a specialist's concerns about resilience of the ecosystems, thresholds and even ecological functionality. For business, the debate may turn into a nightmare of indicators and methods which are not yet available or not developed enough to satisfy every scientist's proposal.

The good news is there is much work to do and businesses are far from being passive in this process. They have come into a new era of partnership between practitioners and researchers to formulate better and more accurate compensation mechanisms. Business and industry have observed some advantages to do more than what is required by law. Voluntary offsets have come true because for the first time in environmental regulation, conservation and business are mutually supportive.

The issue of compensation measures does not end up with these technical thoughts. Compensation mechanisms are themselves socially defined and politically oriented. When it comes to define the scope of the offset schemes, some regulations refer to the "no net loss" concept. This notion may imply a "quasi-perfect" trade-off between values on what is lost and what is recovered and the way it is recovered. Social preferences may play an interesting and unexpected role in the design of compensation schemes. They may even interfere before any decision, aiming at authorizing the impact on biodiversity attributes, is made. In that way, compensation mechanisms come into a political arena in which business, civil society, local and national authorities and conservationists are measuring their forces, arguments and power.

To conclude, much has to be done in this issue and the debate is open to you. It does not mean that nothing has been achieved. The essential point is that complexity in biodiversity matters goes beyond ecological considerations.

RE: Introduction to Session I

Cornelia Nauen, European Commission, Belgium

My comments touch on four types of at least partially inter-related issues:

1. a conceptualisation of externalities affecting biodiversity and other natural renewable resources
2. global trade and the role of multinational companies
3. a comment on the shifting baseline syndrome and what to do about it
4. a comment on the very concept of 'compensation': reminder of a UNEP experience on looking for a legal response to misconduct the consequences of which cannot be compensated for

1. A conceptualisation of externalities affecting biodiversity and other natural renewable resources:

Perhaps it is best to consider the three interdependent resource externalities that affect biodiversity and ecosystems/habitats:

- The 'resource' itself and its dynamics
- The different uses of the 'resource' in a more or less destructive manner
- The allocation issues between competing opinions and groups

This also needs to include the ability to maintain habitats for species and their ecosystems, without which the rest becomes futile.

The difficulty is that the intricacies of all species and their ecosystems are ultimately unknowable (which is not an excuse not to study them, of course). What is knowable, and thus manageable (although complex), is the way humans appropriate and use habitats and associated biodiversity.
The human dimension and associated allocation of resources is complicated enough as a political process dependent on economics, culture and social conditions and their relative evolution over time. But it is imminently manageable.

It is at the level of allocation that many pre-industrial societies tackled resource issues. They had and often still have territorial-use rights, which may or may not be recognised by national legislation, but are nevertheless very real (legal diversity is common): by excluding certain types of exploitation or denying outsiders access to the resources, choosing instead other social compensation mechanisms and a range of other tools. In this way, they were often capable (admittedly under conditions of inferior demographic pressure) to maintain their environments and associated biodiversity intact over very long periods of time.

Exceptions to this are, for example, big animals hunted to extinction even by low densities of human settlers in Australia and elsewhere. A further example is the loss of the Mediterranean forests, largely sacrificed due to boatbuilding during the Roman Empire. Conversely, forest cover (albeit not natural forest) in Europe is one of the very few types of ecosystem indicators pointing in a positive direction as a result of suitable policies which have been implemented.

Thus, there is no question of romanticising traditional tenure systems or other forms of management not steeped in our European cultural preferences, but draw attention to a multitude of experience that could and should inform the mix of sources of knowledge and approaches that could work under different circumstances to arrest the further erosion of biodiversity.

In any event, the sobering results of the Millennium Ecosystem Assessment and the global crisis of land and marine ecosystems suggest that it is unrealistic to think that the technical measures by themselves will work, when they have not so far (despite best intentions).

2. Global trade and the role of multinational companies:
The global reach of markets now effect even the remotest communities and undermine pre-existing integrated resource management regimes that are usually more

respectful of the environment.

The financial power and operational abilities of global companies and their subsidiaries and the considerable economic incentives for fraud easily undo whatever rule developing countries, with their weak institutions and limited enforcement capacity, may try to impose. To give an indication of the scale of the problem:

- The Millennium Project and the future studies of the United Nations list of international fraud, illegal practices and traffic and money laundering are among the top 12 challenges to sustainable development
- Illegal, unreported and unregulated fishing (IUU) is an integral part of the global trade in fisheries products accounting for some 40% of global production according to FAO estimates. It severely undermines fisheries management including such far flung places like the Pacific Islands (FFA, 2000; Hunt, 2003). WWF estimated in 2006 that as much as $4 billion worth of fish are caught illegally. Much of the growth of IUU is driven by overcapacity in countries with oversized industrial fleets (including Europeans) and the very significant level of bad subsidies allocated to them.

This is not to demonise businesses as such. Far from it, however, it might not be wise to blindly rely on more or less sophisticated indicators and consequently not see the creeping change (see reference to shifting baseline syndrome below). Also, voluntary codes of practice have simply not worked in practice because of conflicts of interests and incentives to cheat. Once companies have developed certain capabilities these will be used and any attempt at curtailing these actions primarily with administrative measures would be naïve (see above – countless conference, appeals and little or no action).
The balance between prohibitions/controls and positive incentives for a more environment/biodiversity compatible course of economic development is certainly worth thinking through.

The closer that enterprises operate within the more limited space of local/ national/ regional communities, the easier it is to subject them to social and other norms of these communities. It is the global operators who are more powerful than entire countries and their elected governments that will be brought to heed with the greatest difficultly, if at all. Conversely, locally embedded companies can enjoy the sort of legitimacy that should be good news for their own resilience and balance sheets, provided that there is a level playing field.

3. A comment on the shifting baseline syndrome and what to do about it:
Another important consideration is that without some reconstruction of past states and distribution patterns of biodiversity and ecosystems it is unclear how compensation mechanisms might be effectively operated, particularly in the face of pervasive shifting baseline syndrome (Pauly, 1995). This requires a targeted effort to make the content of occurrence records, collections and past publications systematically available.

The former is increasingly done by GBIF, but the other two functions need more attention and coordinated effort. The Biodiversity Heritage Library scanning activities at least bring the raw material within reach of many scholars, but extracting the content in web-archives would help to bring down the costs of different types of analyses and would, by itself, require a big scientific effort. A proposal is on the table to team up and build www.speciesbase.org documenting biodiversity around the world in a format that makes the tremendous prior work on biodiversity in Europe and elsewhere more readily accessible to all citizens, including, of course, scientists. Right now, mostly aquatic organisms are covered, but that could quickly change through collaborative efforts. By standardising information and making it available in the public domain with the acknowledgement of the source makes the usefulness and visibility of past and on-going work greatly enhanced and encourages new cost-effective routes to advance analyses and for questioning to be developed.

4. A comment on the very concept of 'compensation': reminder of a UNEP experience on looking for a legal response to misconduct the consequences of which can not be compensated for:
Finally, whether biodiversity loss can be compensated at all is open for question.

In relation to environmental pollution, UNEP started a process more than 10 years ago to develop penal law because so many effects of pollution are irreversible and not subject to compensation. At the time, an extensive consultation and negotiation process could not be successfully completed (in the sense of the original intention of UNEP), because awareness of the issues, historical traditions in legal systems across the world and the general perspectives of the parties were too divergent to come together. In any event, the UN system set the beginning of a precedent of what societies might or might not tolerate and where the limits to negotiated outcomes might be.

At this point in time, the unfettered free market attitude might still prevail over all

other considerations, even though we are witnessing a strong move towards socialisation (of the problems, not so much the benefits). But the scale of the environmental (and other?) crisis suggests that a paradigm shift seems to be warranted to make the many transitions towards sustainability that are needed.

When will discussions and negotiations give way to action? Is science critically engaged with society to help these transitions?

Ecosystem functions and compensation schemes

Pauline Teillac-Deschamps, University of Paris, France
Denis Couvet, National Museum of Natural History, Paris, France

To evaluate the impact of industry and human development on biodiversity and ecosystem functioning we need to build new tools to propose robust compensation schemes. The first step is to have strong, global expertise of ecosystem services.

1. Identification and quantification of ecosystem functions:

In this context, compensation schemes need to take into account ecosystem functions which provide ecosystem services. Ecosystem services are defined as the benefits provided by ecosystems to human societies, ecosystem functions are the mechanisms that permit the provision of these benefits.

The importance of focusing on functions is that one ecosystem service can be fulfilled thanks to the interaction of several ecosystem functions, and one ecosystem function can be implicated in several ecosystem services. Moreover, ecosystem functioning can play a role in the maintenance of balancing habitat, species and genetic diversity without any implication of ecosystem services towards human societies. Ecosystem functions are also intimately linked to the resilience of a given ecosystem. Resilience thresholds reflect the capacity of ecosystems to provide services despite and/or after all the perturbations that ecosystems can suffer from.
This requires methods to evaluate and quantify ecosystem functions. These methods should use biodiversity indicators that reflect the state of the function.

Because of the multiple habitats and the diverse functions of these habitats, it is necessary to build robust and global indicators in order to gather all the information needed for assessment, and to create data sets.

2. Biodiversity Observation Network to quantify ecosystem functions:

Biodiversity Observation Networks (see appendix 1) are the tools necessary to quantify the state and dynamics of ecosystem functions, hence to assess impact, and proper compensation schemes. The questions to address will be the estimation of the spatial and temporal variability of biodiversity, hence ecosystem functions, within and outside protected areas, as well as assessing the trade-offs between different ecosystem functions.

Achieving these goals requires mixing observation, research and expertise in an overview of the three levels where biotic diversity is crucial: ecosystems, species and genes.

Such networks are still poorly developed and could consist of:

- Integration of in situ and remote global observation systems.
- Coordination of the gathered data and the delivery of biodiversity change information.
- Gather observations, models, assessments and forecasts (indicators, maps, scenarios).

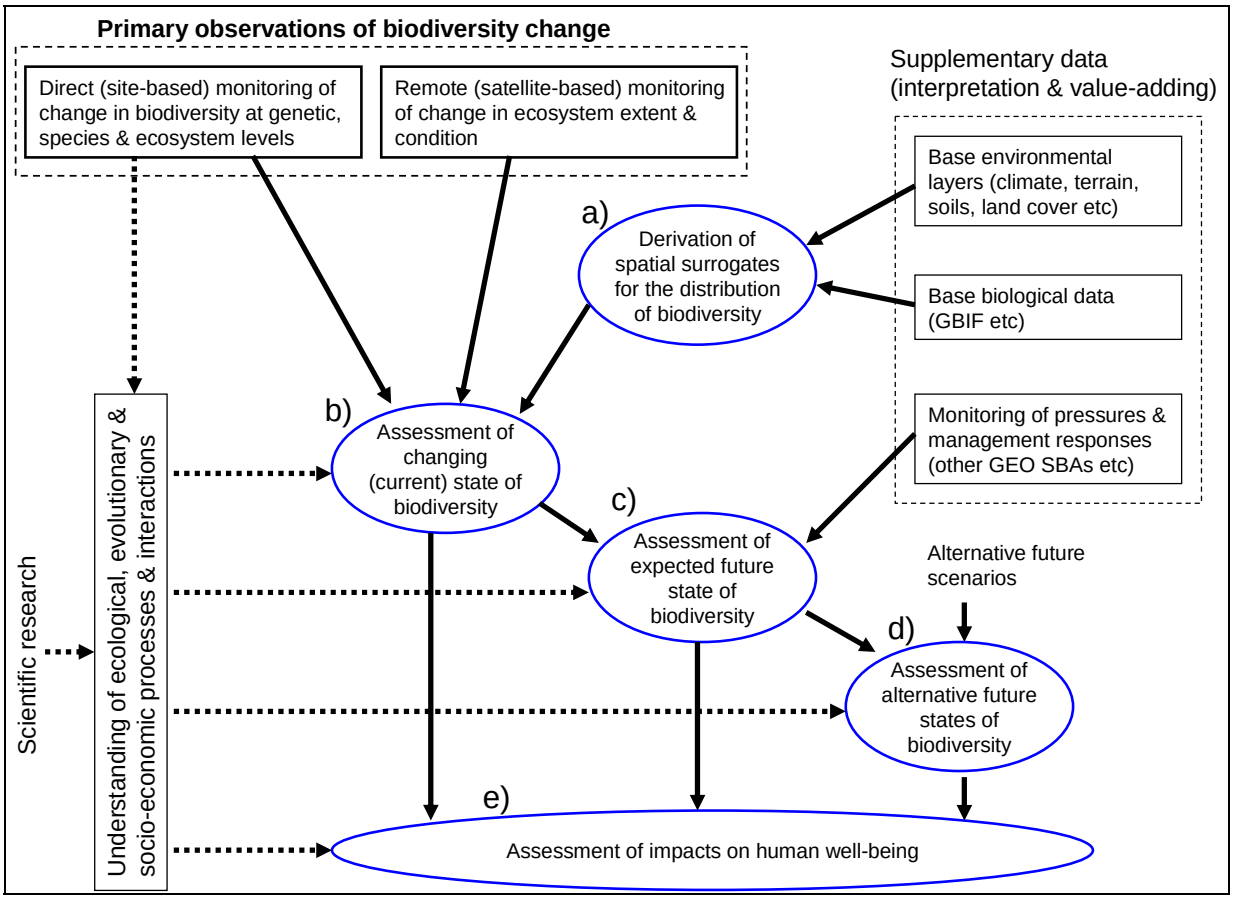

Figure1: Biodiversity Observation Network organisation scheme, as proposed by Geo-Bon

RE: Ecosystem functions and compensation schemes

Mac Callaway, UNEP-RISØ Centre, Rosilde, Denmark

That was a nice, tight comment by Pauline. Ecosystems provide a number of services that directly or indirectly affect human behavior and/or the production and consumption of goods and services sold in markets. All these services can, in theory,

be valued in terms of how much income people would be willing to give to have them or how much income they would have to give up to do without them (without any loss in their welfare in both cases).

Some of these goods and services are easy to value (such as the market value of the flow of timber from a forest). Some of these goods and services are hard to value (such as the waste assimilation services of a wetland), but still natural and social scientists can manage to do that with some simplifications here and there.

Some of these goods and services are very hard to value (help me out here) because either: 1) they undergo many transformations before they affect human behavior and/or market transactions and these relationships are hard to pin down empirically, 2) we lack a lot of the other data needed to use empirical methods to "observe" how these goods and services influence people's behavior and/or market transactions, and 3) we don't trust the methods we have to use (because of problems 1 and 2) to value these goods and services based on people's stated preferences.

But then there are also, arguably, some goods and services produced by ecosystems that leave no traces in human behavior or on market transactions, but people do think they have value.

Please don't confuse the issues associated with valuing this last group of goods and services in economic terms with the first group I spoke about. Often, they get mushed together and this causes a lot of confusion.

RE: Ecosystem functions and compensation schemes

Martin Sharman, European Commission, Belgium

At the risk of stating the obvious, it is easy to put a value on biodiversity or ecosystems services that we use directly or can trade (e.g. food, fibre, medicine, timber, and fuel) but it is far less easy with services that we don't or can't trade (e.g. oxygen production, climate regulation, soil formation, pollination, providing habitat, carbon sequestration, nutrient cycling, decomposition, watershed protection, or sustaining trophic webs). Furthermore, unless you believe that a stated willingness to pay is a valid way to assess the value of an asset that you could never afford, it is essentially impossible to assess the value of aspects of biodiversity that have worth precisely because we don't use them (e.g. existence, bequest, or future options).

It is also perhaps worth repeating Pavan Sukhdev's remark to the effect that any positive discount rate is difficult, if not impossible, to defend either logically or ethically when thinking about the future value of ecosystem services. And a zero discount rate makes the value of any ecosystem service effectively infinite.

RE: Ecosystem functions and compensation schemes

Katharine Farrell, Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany

Picking up on Mac Callaway's contribution, and with much respect for the interventions from Ece Ozdemiroglu and Pauline Teillac-Deschamps regarding the very interesting topic of Resource Equivalency Methods, I would like to add the following four comments for your consideration:

1. Due to the far-from-equilibrium thermodynamics of living systems, and our inextricable embedded relationships with the ecological systems for which monetary estimates of economic worth might be conjectured, I (and I believe many others) find it improbable that it is actually possible to generate empirically 'correct' estimates.

2. Setting about to distinguish between different types of value and appropriate related modalities of valuation seems to me to be a promising direction and one well worth elaborating, in some respect in the ways that Mac Callaway has done here.

3. That being said, when disaggregating various ecosystem related types of economic value, as is now done routinely in environmental economics (use, non-use, intrinsic), the problem remains of how to appropriately estimate the economic worth of functions that reside outside the economic system. That is to say, in addition to a 'warm glow' anthropocentric value of the existence of a forest, there is an operational economic contribution to next year's yields, associated with the mere existence (which is of course no mean feat) of this year's forest. Nicholas Georgescu-Roegen (1971) referred to this as the process fund: the procedural conditions that need to be in place in order for the process itself to continue. Such funds are, at present, not part of the general discussion of ecosystem services

valuations and their incorporation is not a technical but a theoretical problem that requires formal analysis.

4. Finally, I would like to suggest that while reliance upon monetary value estimates as proxies for the economic worth of ecological phenomena, may in some instances be perfectly reasonable and in some even appropriate, in others, it is counter productive to its own ends. The argument supporting this proposition is too long to drag you through here but those who are interested are invited to consult a paper I have written on the topic (Farrell, 2007). I do not wish to propose that we throw the baby out with the bath water, but such an aspiration cannot serve to justify leaving that same baby sitting in the bath…

RE: Ecosystem functions and compensation schemes

Riccardo Simoncini, University of Florence, Economic Science Department, Italy

I find the debate on resource equivalency methods very interesting. From the comments posted it seems to emerge a general disaffection with the possibility that assessment of Total Economic Value of ecosystems goods and services via monetary techniques will lead to a) an appropriate economic valuation of the contributions that ecosystems bring to human welfare; and b) that the economic valuation will be considered in everyday economic decisions of the business world.

As other contributors to this debate have already pointed out, there are many problems with valuing ecosystem functioning and related goods and services. Of course problems of this kind of valuation are harder with certain types of ecosystem goods and services, namely those resulting in public goods (such pollination, soil erosion and run off control, biodiversity conservation, co2 sequestration, etc.), which cannot be traded by markets automatically, than with others, namely those which result in commodities and therefore in possible private goods exchangeable in markets (such as food and fibre, wood and biomass, genetic material for industries, etc.). However, from what we are witnessing in the current economic climate, it seems that markets have not been very good at valuing the worth of commodities either, for example, the financial speculations on the real estate markets in the last few years have made the value of houses skyrocket, but only on paper.

So, as far as I can see, the situation seems to be one where we do have ecosystem

goods and services which are fundamental to life on this planet but we are not able to value them correctly and pass this information on to the wider public and to economic systems. This to me implies, not just a problem of incomplete knowledge of what has to be valued (we already know that without biodiversity life and economic activities would be impossible), but also a problem of translation of biodiversity values using a more effective language than that used so far (i.e. the economic valuation based on monetary techniques). Katharine was referring in her message to Gerogescu-Roegen and thermodynamics theory. I think that it is probably time to seriously investigate the opportunity to have values of commodities and non-commodities (i.e. ecosystem goods and services), assessed both in monetary terms and in some type of energy units, such as how much energy is consumed in producing that commodity or those ecosystem goods and services. Hopefully this double pricing system could be of help in increasing evidence for the strong links existing between climate change and biodiversity loss.

RE: Ecosystem functions and compensation schemes

Rasmus Ejrnæs, Department Wildlife Ecology & Biodiversity, NERI, University of Aarhus

I have enjoyed the debate about the valuation of biodiversity. Biodiversity and nature are close to everything we can observe in the cosmos, and this variety is well reflected in the multitude of suggestions for its valuation.

I would like to make a small contribution in the form of a few short comments regarding biodiversity and its valuation:

Acknowledging a number of interesting exceptions and potentials, it seems rather obvious that the vast majority of species threatened by local or global extinction are not very useful to human societies. Sometimes the ecosystems in which these species live are valuable and useful, but very often the ecosystem services can be maintained or even "improved" in a way that leads to a considerable loss of species, as in the improved grasslands, organic farmland and logged forests of temperate Europe.

It may therefore be a dangerous (however effective) strategy for biological conservation to rely on the effective communication of the notion of ecosystem benefits and services to decision makers.

Our human societies do have traditions for valuation of the useless items (fashion, jewellery, views, silence, fine arts), but the commercial value seems to be related to the possibility of personal possessions. It is hard to imagine the possession of biodiversity (although several extinct species are represented as specimens in private collections!). On the other hand, it is perhaps the buying of land for conservation by foundations and donations that has been the most successful achievement in biological conservation so far.

I predict (and regret) that biodiversity as a common, but useless, good will have a hard time finding its way to the top of political agendas. Quite unlike climate change which is an obvious threat to societies and human welfare.

So, rather than trying to convince politicians about the usefulness of biodiversity, which I find hard to argue for as a scientist, I think we should remind them of the importance and value of the apparent uselessness.

RE: Ecosystem functions and compensation schemes

Joël Houdet, Orée – Entreprises, Territoires et Environnement, CREED, AgroParisTech , Paris, France.

To further Katharine Farrell's (excellent) 4th point, I would first quote Jacques Weber: "A society's system of Values is its system for ordering the universe, the world, objects, beings and the relationships between beings and objects. This overarching typology, unique to each culture, provides the reference system governing the views and attitudes of individuals and groups in the society. Honesty, honor, fidelity, homeland, compassion, as well as the flag and the constitution, are Values in this anthropological sense. These Values cannot be sold, given away, lent, or exchanged: they can only be shared. Values in this sense cannot be expressed in terms of willingness-to-pay : these Values are priceless." (Weber, 2002)

Asking how to integrate biodiversity into the economic sphere leads us to put a price on biodiversity and ecosystem services (BES). One seeks to represent the sum of willingness-to-pay as a 'natural' phenomenon, by playing with rates of extrapolation across space and time and viewing it as if it were the result of a market transaction between a seller and a buyer. This would be like confusing the price that someone agrees to pay for the Mona Lisa with the value of the masterpiece. What price can we put on the bacteria which digest the food in our intestines, the poppies and skylarks in

our fields, or the parasites which cause malaria? It is a safe bet that the price will vary from person to person, and depend on the moment the question is raised. And any such surveys would have to be carefully set up and orentiated! Which population would you choose? A group composed of members of various environmental NGOs? An audience made aware of the challenges posed by malaria on the occasion of the next World Health Day? Households affected by the current stock market crash?

Biodiversity is a social construct, with perceptions varying across space, time and value systems. It cannot be limited to so-called 'natural' areas. Humans and other species co-evolve within ecosystems. The issues at stake, I would argue, are:
(a) the nature of those co-evolutionary dynamics, for every type of socio-economic activity (biological uniformity is currently the most widespread model for producing goods and services) ;
(b) how much would it cost to make it change if society democratically decides that biodiversity is priceless (it seems things are going that way with recent european directives…).

What would be the 'better' option for the co-viability of businesses & biodiversity? (Houdet, 2008)

1. Finding a universal monetary proxy so as to integrate BES into markets for 'optimal' decision-making ?
2. Assessing how much would it cost to make biodiversity a management / production standard for businesses when producing goods and services ?

The first option would (most likely) only be viable for biodiversity provided the costs of offsetting damages are too prohibitive for them to take place in the first place. Besides, it may raise significant issues, from a social perspective, in terms of access to/property rights associated with the BES components or units traded in $ / €...

The second option might open new perspectives in terms of technological, organisational and institutional innovation.

I would agree with Riccardo Simoncini's comment : we need more than monetary indicators to assess the ecosystemic performance of organisations, goods and services. To that end, let us not fall into the trap of seeking another universal, but reductionist proxy. Biodiversity refers to the dynamics of the interactions between organisms in changing environments. It cannot be captured solely through energy or emergy accounting (Odum, 1996).

RE: Ecosystem functions and compensation schemes

Mac Callaway, UNEP-RISØ Centre, Rosilde, Denmark

Martin's comment is nicely put, and I only disagree about one small thing. That is: in theory we can value ecosystem services that leave traces on human behaviour and markets (eventually) through direct (empirical) methods. But practically, it is very hard since, as I wrote earlier, we have a hard time characterizing the physical transformations that these goods and services undergo before they affect human behaviour/markets and we lack a lot of the other data (observations on the effects) to do so. There are also studies that do estimate some of the values on Martin's "untouchable" list, based on direct, revealed preference methods.

Resource equivalency methods

Ece Ozdemiroglu, Eftec (Economics for the Environment Consultancy Ltd), London, UK

This contribution reflects our experience in the EC FP6 funded project REMEDE (Resource Equivalency Methods for Assessing Environmental Damage in the EU) (www.envliability.eu).

REMEDE's purpose is to provide an overview of resource equivalency methods in the context of the Environmental Liability Directive, Habitats and Wild Birds Directives and Environmental Impact Assessment Directive. The REMEDE Toolkit will assist the reader in answering two fundamental questions within this legal context:

1. How are losses of or damages to natural resources or services assessed and quantified?
2. How much complementary and compensatory remediation is needed to restore the losses or damages?

Equivalency analyses take into account the chemical, physical, biological and, sometimes, social and economic nature of an environmental impact and remediation options and follow the same five steps: (1) initial evaluation, (2) damage assessment, (3) benefit of remediation, (4) scaling (comparing) damage against benefit of remediation and (5) monitoring and reporting. Thus, they are essentially the frameworks for negotiation. The wide range of environmental resources and incidents that can cause damage under the relevant Directives, as well as the complexity of the issues raised, prevent universally applicable data and assumptions to be used. Further research should therefore focus on making the whole approach more transparent and also on increasing experience with the application of equivalency analysis.

The following are the key parameters of equivalency analysis where further research would also be helpful:

- **Degree of service loss and service gain (damage assessment).**
  This requires knowledge of baseline (pre-damage) conditions and the nature and magnitude of the damage. The units can be percentage of loss (0 = no loss, 100 = complete loss), numbers of individuals lost, changes in taxonomic diversity, population reductions, loss of reproductive output or viability (including lost lifespan or reduced number of young), and economic value of the loss.

- **Baseline (pre-damage) conditions.**
  It is not necessary to have a complete inventory of all environmental resources to conduct an equivalency analysis. REMEDE suggest approaches when such data are missing. However, more research on how uncertainty about baselines can be incorporated into equivalency analysis will be useful.

- **Damage or recovery trajectory.**
  A description of the time course of service loss or gain (reflecting the degradation or recovery rate of the resource). While extremely dependent on location, resource and cause of damage are dependent on many other factors, further research for protocols on estimating recovery rates could be useful.

- **Metric.**
  The 'metric' is simply the unit of measurement of the service loss and gain and can be any unit so long as it is defensible in the context in hand and can be used both for measuring the loss and the remediation gain. While it is not possible to have a definitive list of metrics, pros and cons of different metrics could be further investigated since the results of equivalency analysis can be highly sensitive to the metric used. Economic value as a metric requires improving both our scientific understanding of the damage and remediation and gathering of more evidence (and interpreting the existing evidence better).

Impact Assessments: Case study, CEMEX

Christian Béranger, Director of Environment and Land Planning, CEMEX, France

In France approximately 1300 companies carry out aggregates exploitation, producing 420 million tonnes in 2007. After the commitment to rehabilitate sites in 1976 and to start carrying out impact studies on sites in 1979, study programmes were set up to evaluate our impacts on our surroundings, with particular consideration of the likelihood of site rehabilitation or the creation of new sites.

For more than 30 years biodiversity studies have been a priority to perpetuate our activities.

Several fields are consistently tackled:

- Identification and understanding of ecosystems
- Evaluation and assessment processes of surroundings
- Rehabilitation technologies
- Site management

Scientists associated with these studies work in close cooperation with the National Museum of Natural History, the Ministry of Environment and naturalists. Increasingly, professionals have committed themselves to the task of valuing ecosystem functions, in particular looking at the connectivity between the network of extraction sites (there are about 30 quarries per administrative area). The density of sites has various effects on ecological richness, particularly for a number of valleys.

These studies have allowed us to:

- put into perspective the impact of operations (discrepancies between the initial degradation of the land compared with the relative richness of the land once restored)
- identify silent and residual impacts
- tackle ecological diversity after rehabilitation

In 2007, the Ministry of Environment and professionals wrote a guidebook on evaluation repercussions compared with Natura 2000. Ecological engineering, specific to quarries, thus allowed statutory principles of compensation to be defined. At this stage, it is possible to consider the production of commercial goods (aggregates) as globally beneficial as long as it is part of an interactive system. That

is to say that the notion of ecological diversity and the agreement (obligation) to pay is too early. In order to identify ecosystem services and their economic value a large multidisciplinary programme has been instigated that is strategically important. This approach will estimate:

- The limitations of study of the economical tools of the market
- The improvement or re-allocation of existing tools (taxes, royalties, and financial warranties) towards new eco-taxation

If public and private investment costs and profits are necessary to help contain biodiversity loss, it will be necessary to have the support of profits from quarry rehabilitation.

The French Foundation for Research on Biodiversity (FFRB) is a means to frame these multidisciplinary reflections, and the Grenelle Environment Green and Blue framework's orientation is a means to apply them as early as 2009.

The statutory framework, which is often unsuited, will then need to be studied in order for plan and programme of the whole state to remain consistent (access to sites, ecologically good water, protection of surrounding land, urban regulation, etc).
Departmental schemes of quarries would be a possible receptacle for this.

Voluntary Offsets

Stefan van der Esch, Biodiversity and Economics, The Netherlands Ministry of Housing, Spatial Planning and Environment, The Netherlands

N.B. The views expressed in this contribution are the author's and do not represent the official position of the government of The Netherlands.

Industry initiatives that account for the pressure on biodiversity at the beginning of their production chain are an important first step towards an internalization of environmental costs resulting from biodiversity loss on an international scale.

A production chain perspective…

Several initiatives are under way to explore means by which the private sector might increase its contribution to the preservation of biodiversity and ecosystem services. The Business and Biodiversity Offset Programme (BBOP) looks at direct offsets at the impact location and is fielding a number of pilot schemes to gain experience on its feasibility. UNEP and IUCN promote International Payments for Ecosystem Services (IPES), with the intention to scale up existing PES experiences. These are valuable initiatives, as they provide concrete actions and a floor for important discussions. However, it is essential to add to these a production chain perspective to account for both environmental pressure exported across borders through international trade and for the global benefit of conservation efforts.

The loss of biodiversity and the great deal of services it renders locally, regionally, and globally is a worrying prospect, and is acknowledged by the world's governments. Much of this loss occurs because of increased land use and clearance for production purposes – in fact, clearance and degradation are the number one cause of the decline. Its origin cannot solely be attributed to the countries where this takes place but to the consumers of its products as well. International demand for products increases pressure on local production efforts. Internalization of these environmental costs would be best organized at the point of impact, by reducing and mitigating impacts towards sustainable production and perhaps even offsetting in order to safeguard biodiversity and ecosystem services. However, a variety of barriers may prevent this, such as: the policy priorities of less developed countries may include more pressing issues, funding for assigning and maintaining protected areas is unavailable, etc. And a fundamental issue: part of the benefits of conservation efforts are enjoyed globally, while the brunt of the costs often needs to be born locally.

The role of industry in this seems therefore not only very much wanted, but essential. Modern firms trade in part of or even entire production chains, often covering two or more countries before their product ends up with the consumer. Companies are increasingly sensitive about their climate impacts, often voluntarily offsetting their CO2 emissions. If provided with the means and instruments to do so, could industry be willing to work on charting their biodiversity impacts through the production chain and consequently include the costs for compensating this impact in the price of their final products? Would companies be willing to look beyond their own direct responsibilities and look at the original impact of their products?

...and a practical approach

To illustrate, imagine a furniture manufacturer crafting closets and chairs from tropical timber from Ghana, obtained from a trading company. The manufacturer has little to no direct impact on the tropical forest, but using the timber, even certified, 'sustainable timber', has an impact due to logging, transport and disturbance. A producer of meats and sausages for catering services has little direct impact, but obtains cattle as an input for his products. The land use for cattle as well as for their fodder does add significant pressure on natural areas. Whether this amounts to company responsibility seems of little relevance as long as there are no instruments or means to actually make it possible to link final production to impact.

Such an instrument will necessarily yield some accuracy, in favour of simplicity and a broad applicability. There are clear avenues that can be taken. One of these might be to take the primary driver of impact, i.e. land use, and calculate area needed for the production of raw inputs. The same area could then be the object for compensation. Characteristically, this will lead to impact assessments across national borders but also to compensation across national borders.

Quite a number of key-questions come up and need to be decided upon. For example: how do you account for differing qualities in biodiversity and ecosystem services? What and how to compensate: should it be like for like, and how can you be sure of this when you're a company at the end of a production chain and obtain your inputs from a variety of traders? Compensation could take place by restoring areas and thereby increasing their value to biodiversity, or by protecting areas that are under heavy pressure of shifting agriculture and construction, in which case it would be necessary to account for the question of additionality. It would then still be up to a company to decide whether it will organize this activity itself, enter into a league with

a conservation organization, or perhaps outsource the compensation activity completely by for instance partaking in a conservation programme. And finally, what would it imply to sanction compensation from the end of a production chain, when one cannot be sure if impacts at the beginning of the chain have been avoided and mitigated as best as is reasonably possible?

These are key questions, yielding exciting discussion, and can be answered or agreed upon. Perhaps not perfectly as of yet, but learning by doing might be the only option to do so.

Social and economic dimensions in multi-criteria evaluation of biodiversity

This contribution outlines the role of multi-criteria decision aid tools to simultaneously consider a wide spectrum of different dimensions of sustainability.

Stanislav Shmelev, Environmental Change Institute, University of Oxford, UK

Multi-criteria evaluation of biodiversity for the purposes of mitigation banking presents a methodological as well as a practical challenge. The use of multi-criteria decision aid tools allow simultaneous consideration of a wide spectrum of criteria, which can and should represent the different dimensions of sustainability, including the following themes: poverty, governance, health, education, demographics, natural hazards, atmosphere, land, oceans, seas and coasts, freshwater, biodiversity, economic development, global economic partnership, consumption and production patterns (United Nations, 2007) or the social, environmental and economic dimensions of sustainability in the previous edition of the United Nations Guidelines. The new edition of the Guidelines emphasizes thematic linkages that exist among different sustainability dimensions: e.g. the indicator percentage of trees damaged by defoliation is related to the key thematic area "land" as well as biodiversity, and consumption and production patterns. Fragmentation of habitat is related to the key thematic area "biodiversity" as well as governance, land, and consumption and production patterns.

Existing studies have identified the following socio-political criteria in biodiversity assessment: economic cost, recreational value, human population, future economic value, scenic beauty, cultural heritage, and educational value (Moffet and Sarkar, 2006). The Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2004) describes the following cultural services provided by the ecosystems: cultural diversity, spiritual and religious values, knowledge systems (traditional and formal), educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, and recreation and ecotourism. Methods illustrating the economic value of biodiversity have been reviewed in Nunes and van den Bergh (2001). Regan et al. (2007) present a coherent set of environmental criteria for evaluating biodiversity. Moffett and Sarkar (2006) present an extensive overview of the existing applications of multi-criteria methods to the problems of biodiversity evaluation. It is interesting to note, that the majority of the studies reviewed in this paper have been carried out with the help of the MAVT, AHP or goal programming methods. It should be said that the use of social criteria has been particularly rare in

multi-criteria evaluation of biodiversity.

The following approach seems to be the most productive when addressing the social and economic aspects of biodiversity evaluation: identification of all the relevant stakeholders in the region, design of a questionnaire where the potential social, economic and environmental criteria would be identified and presenting this questionnaire to all the stakeholders with a request to assess using a scale (e.g. from 1-10) the relative importance of various criteria for that particular region. The stakeholder responses could be used as a starting point for identifying the priorities. Then, using diverse GIS datasets, depicting various types of protected territories, species richness, information on the centres of population density, number of tourists, etc further analysis could be performed with the aim of integrating the social preferences with the ecological data.

Multi-criteria decision aid tools differ by the type of problem they are trying to address (Roy, 1991). Four main problems are distinguished:

1. Selection of the best alternative or a non-dominated subset from the set of alternatives
2. Assignment of the objects in the set to one of several predefined categories
3. Creation of a ranking among alternatives
4. Verbal description of a multi-criteria decision problem

It seems that in the case of estimation of the relative importance of the particular sites for the purposes of mitigation banking, the problem could be the most relevant. In this case each territory could be assigned to a predefined quality class, e.g. from extremely valuable, to not valuable at all, with 5-7 classes in between. Therefore, a decision could be made as to which quality class this territory belongs to and which other territories belonging to the similar class could offset it, should it be necessary to use it for development purposes. The MCDA method ELECTRE TRI, developed at University Paris Dauphine, could be a good candidate for such an application. The method will require explicitly defined boundaries in each criteria for each class under consideration. Other alternative methods could be considered, but a decision should be made as to which level of compensation among criteria is appropriate for biodiversity evaluation schemes, with more compensation leading to the weaker sustainability and less compensation leading to the stronger sustainability solutions.

Business and biodiversity both in urban and in Natura 2000 areas within a complex political, juridical, social and economic context

Jan Jansen, Radboud University Nijmegen, Department of Aquatic Ecology & Environmental Biology, The Netherlands.

The author shares his experience about the synergy between business and biodiversity in two different environmental planning areas: urban and Natura 2000.

Business and industry have indeed observed some advantages to do more than what is required by law, as was stated by Sarah Hernandez in her introduction to this session.

This week there was a press release about the international shopping centre specialist Sonae Sierra receiving the Green Thinker Award, see http://www.greenthinkeraward.com/index.html
The company has been focusing on sustainability in the development and operation of its shopping centres for ten years now.

Sonae Sierra owns many shopping centres in Portugal, Spain, Italy, Germany, Greece, Romania and Brazil with a gross lettable area of almost 2 million square metres and for another 1.2 million square metres they are developing projects or have new projects in various phases of completion. All these sites need maintenance including the green areas.

The best way to maintain the green areas most cost-effectively is to follow the ecological concept. Each of the aforementioned countries has a specific climate, a specific native flora, specific soil conditions and invasive species problems. This can vary even within one country. Applying native species adapted to the local ecological conditions of each site will save management costs and costs of controlling invasive species. Adapted species will for instance be very efficient in using water resources and nutrients. In addition they are likely to be less sensitive to disease and more easily managed. Sonae Sierra used for instance the ingenious concept to increase site ecological value by ensuring the use of native tree species.

Sonae Sierra operates usually in urban areas, but what if a company operates in or nearby Natura 2000 areas?

About seven years ago I was asked by another company to give advice on a public-

private cooperation project in a Natura 2000 area. I already wrote about that some 3, 5 years ago in an earlier EPBRS conference, (http://www.edinburgh.ceh.ac.uk/biota/Archive_scaling/6581.htm)

The idea of the public-private cooperation project was to come to an agreement between the owners of a particular locality and the local management authorities (mainly ICN now ICNB) to manage the area in such a way that both parties could profit without destroying the original character of the major part of the site. The owners wanted to invest in accommodation facilities. A part of their profit would be used to manage the area sufficiently according to both national and EU regulations (Habitat Directive). In return the authorities would allow the owners to build under certain restrictions. Possible justification allowing construction under restricted conditions came from the effects of not allowing construction. Because not allowing construction would mean continuation of abandonment and consequently final loss of environmental values through replacement by alien species since the site was already largely occupied with invasive non-native species. In addition active management of the owners would have restored the original vegetation already destroyed by the invasive species and conserve the existing high quality vegetation of which some are marked as priority Natura 2000 habitats. We recommended following an integral approach tackling both construction and environmental management.

However the Portuguese government stopped the project some time before construction would have started, probably because there was not a reliable juridical-political basis for it. Perhaps there was also a social problem. People often distrust real estate companies, thinking that nature is always sacrificed for economic interests. Now we are 7 years on and there is an increasing number of companies that are far from being passive in the process of taking action to stop biodiversity loss and to use ecological principles to raise their profits and public image.

Recently I was able to see the site in question again and observed that hardly any original Natura 2000 habitat survived the "attack" of the invasive species. In this case the company could have saved these biotopes because both technically and economically spoken we would have been able to rescue the Natura 2000 habitats. This is just an example that is in line with Sarah Hernandez' conclusion: an essential point is that complexity in biodiversity matters goes beyond ecological considerations. To restore the damage done to the Natura 2000 biotopes will be very expensive for tax payers and the question is whether the actions will be successful.

Today environmental regulation, conservation and business can be mutually supportive. I really hope that at present we are closer to a large-scale National or European network that will work on solutions for complex socio-economic, ecological, political and juridical problems, than we were 7 years ago. Such a network should be able to facilitate cooperation at the local scale delivering cost-effective 'made-to-measure' solutions to specific local variants of complex ecological problems.

Let me finish with the same question I asked 3, 5 years ago:
Do any of the participants have good experience with similar public-private cooperation in nature management?

Impact evaluation and compensation mechanisms – some conclusions from the Biostrat National Report for Germany

Marcus Zisenis and **Carsten Neßhöver,** Helmholtz Centre for Environmental Research – UFZ, Germany

The Biostrat national report on the German mitigation and compensation regulations for project and planning impacts on biodiversity, which are obligatory for public and private companies. They are mainly based on the respective European EIA and SEA Directives, but also on impact compensation regulations at a national German level. In practice however, Biodiversity impact assessments in Germany show severe quality and systematic deficits, which hinder an effective protection and enhancement of the different values of biodiversity by companies and other operators. They need to be altered towards an innovative project and planning process, which encourages private and public companies to integrate biodiversity measures in their company policy by binding market mechanisms.

The Biostrat national report for the EPBRS meeting on "Biodiversity and Industry" shows that for mitigation and compensation regulations for project and planning impacts on biodiversity in Germany, there are theoretically mitigation and compensation measures necessary for all kinds of significant impact level of certain project related thresholds and their interactions. These regulations are based on the respective European EIA and SEA Directives, the EU Habitats and Birds Directives, as well as on impact compensation regulations at a national German level.

However, in practice the quality of impact assessment studies on the environment is rather low in Germany. There is no comprehensive evaluation framework used, which takes into account the different values of biodiversity as mentioned in the preamble of the CBD and a certain limited number of evaluation criteria to assess them. Often the survey, analysis, and evaluation parts are not clearly separated from each other. Biological components are mostly under represented, as well as their relations to the different values to human beings. EIS and Impact Assessments generally lack of an interdisciplinary team of scientists and effective participation of the public in the decision making process.

These circumstances hinder effective protection and enhancement of the different values of biodiversity by companies and other operators. A systematic biodiversity evaluation framework needs to be applied, which takes into account comprehensively,

transparently, and comparatively the different values mentioned in the preamble of the CBD. Furthermore, market mechanisms need to be developed in integrating binding biodiversity measures into economic incentives, such as tradable land use rights of biodiversity quality standards. Impact assessment regulations at a European and national level need to be improved by sufficiently integrating the public knowledge and enhance acceptance of private and public project and planning decisions.

Research Recommendations:

Research is urgently needed on integrating tools of biodiversity values into the different land use processes (agriculture, forestry, fishing, urban and rural development, transport, industry, etc.), for instance, in implementing the German National Biodiversity Strategy, instead on focusing on ineffective impact assessments and compensation measures.

Biodiversity restoration in Russia: impact evaluation, compensation mechanisms and the business initiative

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Vladimir Vershinin, Institute of Plant and Animal Ecology, RAS Ural division, Ekaterinburg, Russia

A legislative regulation exists concerning any impact on biodiversity in the Russian Federation. The Ministry of Natural Resources and Ecology of the Russian Federation (http://www.mnr.gov.ru/) defines the order of examinations on industrial safety and stipulates the requirement to register the conclusions of the specified examination. The same rules apply for different kinds of indsutry – energy, mining, water power stations, buildings, e.t.c. Ecological monitoring of environmental quality is also organized by the Ministry and its local divisions. Unfortunately, the development of the "wild market" in Russia during the last 15 years and the structural reorganization of the use of natural resources are not supporting measures directed at biodiversity conservation.
Because of this:

- There is no positive experience of ecological regulation under these new conditions;
- New mechanisms for biodiversity conservation are still under construction;
- There is very little professional training for experts - ecologists, which should supervise mitigation of disturbed biodiversity;
- Preventative measures against biodiversity loss are mostly an exception to the rule.

Because of these reasons, after a private or state companies impact on biodiversity an investigation of the Federal service is carried out which looks at the supervision in the field of natural resource use and its conclusion about the administrative or judicial responsibility of the company. It is usually after this has been carried out that measures can be set in place to account for mitigation and/or compensation of the biodiversity loss. Public organisations can take the initiative for mitigation, but these measures are not significant without financial support.

There are specializations in some Russian universities on the subject of ecological management, in Tomsky State University for example. These specialties were founded in cooperation with British universities. But it is too early to speak about the art of Ecological engineering because there is no serious demand for this in state or private companies. The company often require "specialists" for hiding biodiversity

loss from the Federal service and to avoid the subsequent penalty. Unfortunately, that is a more frequent practice.

There is no information on serious or small biodiversity research being supported by private companies.

Some small steps in regional business and biodiversity initiatives are related to the use of natural resources for hunting or fishing. Protection and funding on some hunting exists in very restricted areas and for "useful" species only. Heads of some business companies are managing the initiative, because they are fond of hunting or fishing. The only similar initiative to the business initiative is the Centre on Bird of Prey Monitoring and Rehabilitation "Holsan" (http://www.actinfo.ru/agricul/company/companycode=6404482) headed by O.A.Svetlitsky registered as a non-commercial organization. The Centre specializes in the breeding and sale of birds of prey in the Ural region.

Session II: What ecological engineering is needed?

Introduction to Session II: What ecological engineering is needed? The emergence of ecological engineering

Nathalie Frascaria-Lacoste, University of Paris, Orsay, France

Traditionally human actions have not been evaluated. As a result, society did not notice or understand ecological integrity or health because degradation was local and usually transitory. Now times have changed and degradation is everywhere. From this evidence, two disciplines of fundamental importance to human society: engineering and ecology, have expanded at unprecedented rates. Ecological engineering is a new field with its roots in the science of ecology. It can be viewed as designing or restoring ecosystems according to ecological principles.

Primary efforts in ecological engineering research and practice have proven to be a difficult first step towards constructing a new engineering discipline based on ecology. Case studies, demonstrations and applications related to restoration, rehabilitation, conservation, sustainability, reconstruction, and remediation of ecosystems using ecological engineering techniques are now numerous. Society requires both disciplines to improve their expertise by expanding their interactions with the public. Those interactions must be based on mutual respect and understanding and on actions to avert the consequences of continued biotic impoverishment.

Nevertheless the lack of connection between theory and practice remains a real challenge. Indeed, development in this field requires more discussion and interdisciplinary interactions between both engineers and ecologists. Most protagonists of one of these disciplines have only limited knowledge about the other, and fundamental conceptual differences have limited their interaction. The failure of engineering to recognize the importance of biological limits and connectivity within biological systems is matched by the failure of ecology to contribute to the resolution of important societal problems. In addition, engineers and ecologists fail to address the right problem at the right time. Ecology as a science is not routinely integrated into engineering costs. Engineers often miss Ecology. Ecologists spend too much time trying to understand problems before they take action. They may be incapable of contributing useful solutions because they get lost in the details of natural environmental variation.

RE: Introduction to Session II: What ecological engineering is needed?
The emergence of ecological engineering

Dave Stanley, E3 Sustainability, UK

Alain Bedecarrats questioned where the funding might come from for ecological engineering. This session asks "How can we combine research and practices within societal constraints" suggesting that this question needs modifying to societal and economic constraints.

Not an unconnected thought - as global share prices have roughly halved, presumably this means that the economic value of man-made capital is now worth half of what it was a year ago. Does this mean that 'natural capital' (ecosystems) is now also worth half, or has it doubled relative to man-made capital?!

To shift towards genuine sustainability I would suggest that in seeking to define the type of (ecological) engineering that is needed it is vital to identify the actual problems we face, and the linkages, rather than address the impacts - be it climate change or ecological degradation.

Current ecological degradation is largely caused by the extraction/destruction/discharge arising from continuous consumption of resources to supply 'economic growth', which itself requires increasing amounts of energy (largely fossil fuels) to support the 'growth'. Check the UK Office of National Statistics, which shows that when the embodied energy of imports is added back, almost without exception, every economic activity in the UK has over the last 15 years increased its primary energy input. In contrast Russia has had a decline in economic growth, reduced its energy demand and hence has GHG credits to trade. Russia's impact on global ecosystems arising from resource consumption must have decreased (management of pollution from discharges may have deteriorated).

It is not just that the consumption of fossil fuels resulting in the emission of GHGs causing climate change which has a negative impact on ecosystems that is the problem; it is also the employment of the energy itself that then negatively impacts on ecosystems. Switching to biofuels for a trawler does not stop the depletion of fish stocks, or switching to biofuels for road construction and transport in the Amazon basin does not stop the loss of rainforest. However a reduction in total energy would reduce resource consumption and ecological degradation.

I would suggest that if ecological engineering represented low energy (exosomatic) input, engineering that capitalized on natural cycles and photosynthesis, we would indeed move towards win-win solutions (reduced GHGs, resource depletion and ecosystem degradation). It would of course be high on endosomatic energy - or more jobs.

Redefining wealth in terms of 'wellbeing' rather than economic growth would also be necessary.

Ecological restoration and environmental management

Alain Bédécarrats, CEMAGREF, Grenoble, France

This contribution focuses on issues related to the ecological restoration and environmental management of terrestrial areas strongly disturbed by human activity in France.

These areas are disturbed because they are part of infrastructures designed for tourism, transportation or energetic aims (such as ski resorts, TGV railroads, large river embankments such as the river Rhône, and quarries, etc).

Industrial firms in charge of these areas differ in their aims and organization. However, since the start of this century they have taken part in the cultural shift triggered by the collective awareness of the necessity for sustainable development in response to the peril of global change. Nowadays these firms are beginning to implement management strategies with rationales referring to three levels:

1. The firms devise environmental management plans complying with their own vision of the economic world (for example, use of environmental quality standards, such as the ISO 14001 standard)
2. Because the concerned areas are part of territories, the environmental plans are embedded in collective visions built up with the other stakeholders of that territory
3. These bottom-up approaches are coordinated at the national level by the use of specific action-plans from the National Strategy for Biodiversity (which delivers the European Strategy in the French context)

These environmental strategies foster practices referring to ecological restoration and conservation, ranching, conservation ecology and sustainable tourism. The practices contribute to the design of sustainable systems consistent with ecological principles and the integration of human activities to the natural environment. However, an integrative approach still needs to be built in order to articulate these practices, ecosystems services and functioning at spatial and temporal scales. Ecological engineering should be the basis of this integration.

It is a truism to say that ecological engineering is still in its infancy. Future developments will need investments in fundamental and applied research, in education of skilled professionals, in knowledge transfers and in organization of

professional networks. The task is huge and expensive. In my opinion, the success of that endeavour implies financial investments which have to be found in the economic world.

In addition, something that could be called "a value of nature" is emerging from implementation processes of these strategies. Indeed, because society's environmental awareness is increasing, taking care of nature becomes a competitive factor for firms. Moreover, taking part in the management of biodiversity at a territorial scale also requires contributing to the management of nature as a public good for the benefit of the territory. In an economical prospect, some kind of specific wealth is certainly created.

These thoughts raise some questions:

- Is there enough wealth to raise funds to be invested in the development of ecological engineering?
- If not, then how could a stock market for biodiversity be created from which such funds could be raised?
- In all cases: how could fund raising and allocation of funds be organized in order to develop ecological engineering?

This text has been written by a researcher in the field of ecology and ecological engineering, with little experience of economics. So, the author apologizes for his clumsiness in the use of some technical terms.

Ecological engineering and sustainable management of the environment

Patricia Genet, Biogeochemistry and Ecology of Continental Environments (Bioemco), Paris, France

Ecological engineering is a young developing discipline which can play an important role in designing sustainable management practices of the environment.

The actual biodiversity crisis raises growing concern, not only among ecologists but at all levels of society. Human activities have a growing influence on the biosphere and this impact's on biodiversity at all scales. This is particularly true in farmlands due to the use of improved varieties, machinery, fertilizers and pesticides, in order to increase food production. However, both increased chemical inputs and the number of agricultural practices in the field tend to perturb biological processes in soils thus modifying the global functioning of ecosystems with potentially unexpected and undesirable results for humans.

Human well-being (food, water, clean air, shelter, health and safety) depends on services provided by ecosystems. Nowadays, feeding a growing human population is a challenge for society. We have to produce more and more and also need to take into account the growing societal demands for clean agriculture and high-quality food. At the same time new technologies, such as biofuel production, require agricultural soils and thus create competition between food and fuel production for land use. Ecological engineering can play an important role in conserving biodiversity and supporting ecological processes beneficial to human well-being. An ecological engineering approach uses theoretical knowledge in ecology to design ecosystem management practices that are environmentally, socially and economically viable and sustainable. This discipline tries to minimize human intervention and increase natural processes.

An example of ecological engineering already in use is phyto-remediation. This is a technology which uses the nutrient accumulation capacity of plants (including trees, herbaceous, aquatic plants), to remove, destroy or sequester pollutants from the environment. In the same way, there is increasing interest in mycorrhizal fungi, which improve mineral nutrition and growth of plants and are root symbionts of almost all plant species. The sustainable management of symbiotic fungal diversity in soils would allow a higher productivity (with less chemical inputs) and diversity of plants to be used for food or biofuel production, or re-vegetation of degraded lands, thus

avoiding erosion and desertification.

Sustainable environment management for the future is one of the main interests for society. A way to make people aware of the huge challenges we have to face is to estimate the economical value of services provided by ecosystems. A recent study evaluated the total economic value of the ecosystem service of pollination worldwide to be approximately £120 billion (€153 billion), which represents 9.5% of the value of the world's agricultural production used for human food in 2005 (Gallai, N. et al., 2008). However, this kind of evaluation is difficult, in part because of the lack of understanding of biological mechanisms underlying ecosystem services. To achieve this, pluridisciplinary and interdisciplinary approaches are needed.

In the future, ecologists, engineers, economists, social scientists, practitioners, and decision makers, all have to combine their efforts to communicate (i.e. use the same language) and to interact (i.e. link ecological research and applied research). This should allow the development of new technologies which will change our way of thinking and acting.

Integrating Ecological Engineering into the Strategies of Private Enterprises

Manuel Blouin, University of Paris, Paris, France

Ecological Engineering (EE) was first defined as "those cases in which the energy supplied by man is small relative to the natural sources, but sufficient to produce large effects in the resulting patterns and processes" (Odum, 1962). Taking into account concepts such as system analysis, auto-organisation, external forcing, stability, complexity etc, this definition gives enormous potential for the integration of EE in private enterprises' strategies. In this contribution I have identified three ways to integrate EE.

1. Integrating EE as a logistical tool:

In industry, EE can be used as a way to design manufacturing processes. It could use waste as co-products, for example as an energy source which could feed the process chain. In trade, it can help managers to design processes that decrease energy and money consumption for supply or distribution patterns. In the building industry, EE can help to design a building which minimizes expensive energy consumption for heat, oxygenation, e.g. by using natural alternatives like plants or 'greener' alternatives such as solar energy. In agriculture, EE can help to avoid the use of many pesticides and fertilizers when managing soil fauna and plant communities. In territory management and urbanism, EE can help to design functionally efficient and multifunctional territories, with an optimal delivery of goods and services.

2. Integrating EE as an assessment tool:

EE can help to evaluate the impact of human activity (industrial or not) on the environment, by potentially replacing or combining conventional physical and chemical assessments with bioassessments. Bioassessment is the use of biological indicators as a measure of the availability of a product (toxic, pollutant, beneficial molecules) for organisms. This is not a value defined by physical and chemical measurement procedures, but instead an integrative approach of pollution, which takes into account the sensitivity of biological organisms to toxins and the subsequent effects of metabolic sub-products.

3. Integrating EE as an activity per se:

EE is an economic activity, which could be the major intellectual resource for many consulting agencies.

An analysis of the conditions for EE in order for it to be a good alternative to previous practices could be done for each of these aspects.

However, it appears that not all activity sectors are equally amenable to EE. A major challenge in the development of EE in private enterprises is to define in which activity sector(s) a real potential exists. Technological aspects have to be taken into account (are the science and techniques developed enough?). Economical aspects would often be a useful argument, given the increasing price of non-renewable energy, but have to be precisely evaluated, with the integration of "externalities". Social aspects are also important (are people ready to adopt a sustainable development attitude?).

RE: Integrating Ecological Engineering into the Strategies of Private Enterprises

Joël Houdet, Orée – Entreprises, Territoires et Environnement, CREED, AgroParisTech; Paris, France.

Picking up from Manuel Blouin's contribution, I would first like to point out that Biodiversity is currently mainly being used as:

- an evaluation criteria for environmental impact assessments;
- a standard for land management purposes (Natura 2000 sites for example)

With respect to Manuel's first point "Integrating EE as a logistical tool", would it be possible to make biodiversity a management/production standard for businesses when producing goods and services? For instance, could we not use the diversity of living organisms and their interactions as an alternative to production models that rely on homogenous habitats or associations of living systems (single-crop agriculture)?

This may have implications in terms of (among others):

- Medicine/health (using the diversity of micro-organisms to regulate populations of pathogens; Aron & Patz, 2001)
- City planning/construction/infrastructures (see Robbert Snep's contribution in this session of the e-conference)
- Food and beverage industries; farming for both food and energy crops (diversity of crops and biotic interactions within the field, not outside of it; Hector, et al., 1999).

When assessing the technological and organizational feasibility of such a proposal, we must concomitantly find ways to make them profitable for businesses. That would

imply looking at current modes of regulation, that is how value creation is recognized at each step of the supply chain (from an accounting perspective) and shared among economic agents (market mechanisms, taxation system).

Ecological engineering, a multidisciplinary approach taking into account both socioeconomic and ecological interests: The case of rehabilitation of severely eroded mountainous catchments

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This contribution outlines the role of ecological engineering in ecological restoration of degraded landscapes. In particular the author considers the rehabilitation of eroded mountainous catchments.

Freddy Rey, Cemagref Grenoble, Mountain ecosystems research unit, France

Ecological engineering brings the fruits of research to the field of management of ecological systems. In the case of rehabilitation of severely eroded mountainous catchments, research, especially in the fields of geosciences and restoration ecology, can be used in an interactive process with practitioners in defining ecological engineering principles for erosion and sediment control. Erosion is a natural hazard with alarming consequences worldwide. Erosion and sediment control within herbaceous and woody vegetation habitat is a major challenge today, especially on degraded mountainous landscapes where the consequences of severe erosion threaten socio-economic and ecological interests such as on torrential catchments, riverbanks and agricultural land.

Ecological restoration, the action of restoring areas of degraded land, can be implemented on eroded terrain. It is based on several scientific groups: restoration ecology, plant ecology, soil and geosciences, as well as sociology (taking into consideration the social acceptability of the methods and tools proposed) and economics (for economic compatibility). This requires a multidisciplinary approach. Ecological restoration of degraded ecosystems aims at restoring their functions to reach autonomous and stable ecosystems characterized by efficient and sustainable control of erosion and sediment

However, the various socio-economic contexts across the world mean that various objectives for restoration operations can co-exist. Certain countries have significant financial means and implement optimal restoration actions. They are able to achieve true restoration, with the goal of recovering the original ecosystem that had been damaged. Other countries experience more restrictive situations and aim at financial and energy savings, seeking to minimize interventions: this is called minimal management. In this case, only operations of rehabilitation of the eroded ecosystems can be considered, with the second type (described above) limited to the minimum or

even deleted. Therefore, recovering the previous ecosystem before degradation is not the final aim, but rather reaching a determined ecosystem objective in response to the existing technical, socioeconomic and ecological problems.

In both situations, engineering tools are needed for the application of restoration or rehabilitation actions by practitioners. These tools have to be discussed with all the different actors in order to determine the most interesting solutions by considering cost-effectiveness ratios. Moreover, practitioners need more refined knowledge on the interactions between vegetation, erosion and sediment dynamics. Current research mainly aims to quantify the efficiency of vegetation and bioengineering works in erosion and sediment control. In particular, in the viewpoint of minimal management, the thresholds of this efficiency and the optimal dimensions of bioengineering works must be determined. This is the case in the French Southern Alps in determining ecological engineering principles for the rehabilitation of severely eroded mountainous catchments. Strategies for fine sediment retention with bioengineering works have been set and adapted with practitioners.

Ecological engineering within firms and industries

Regis Maubrey, GREENWAY International, Paris, France

With some references to local French situations as well as cases in developing countries, it is surmised here that it may be harder for the public sector to contribute to supporting local biodiversity and ecological engineering, than it will for the private sector ("firms and industries").

For clarity's sake, let us say that the terms "firms and industries" used in this contribution refer to private sector organizations, meaning "for profit" companies, firms that show solidarity with other actors sharing the same territory, and industries that work within what is called the "social economy". The terms therefore cover a wide variety of organizations, which do not depend on regular public subsidies, and do not depend on volunteer workers, thus opening up the topic of this contribution to the complexity of situations where local biodiversity is an issue.

Generally speaking, and based on observations and experience of some 30 years in the field, one may assume that such "firms and industries" can and will contribute to supporting local biodiversity and ecological engineering only once they are instigated by other local stakeholders (community based organizations, town halls, agencies), through awareness-raising efforts; or by encouragement and incentives (or even obligations) through local ordinances and national legislation.

Ecological engineering represents a shift in perspective (and thinking) regarding "engineering" itself, as well as regarding "landscapes" and management of territories. The main hypothesis here is that it may in fact be harder to bring about this shift within the public sector than in the private sector (referring still to "firms and industries"). Indeed, on this topic, thinking within a company can evolve faster than that of a community or town, because a company's culture generally will examine the economic advantage of different projects and activities, such as greater dependence on ecological services.

For example, managing a natural prairie ('managing' because the industrial site may be within a deciduous forest biome, such that a prairie ecosystem may have to be artificially controlled) by the removal, felling, of ligneous species (saplings). Indeed, similar shifts have already occurred for similar "environmental" issues, such as waste management, and are presently occurring around ecological buildings. Indeed, private

sector organizations ("firms and industries") tend to have increasing interest, global reach and presence throughout the world. So their potential for positive and negative impact on the issue of ecological engineering and biodiversity could be considered more important than that of local communities who generally only act locally for immediate and local interests and priorities.

What could eventually be proposed here is to examine this hypothesis with more applied, multi-disciplinary research, involving both laboratories working on natural systems, as well as sociologists, economists and management experts, working on private sector issues. Hence "national reviews" mentioned in the URL (http://www.biostrat.org/), should include the identification of inventories such as those required for quality (and especially environmental quality and performance certification) approaches. One could imagine the inclusion of an assessment of species present (or a species presence list), for example, within eventual life-cycle analyses (within the ISO 14000 environmental quality standards series), especially including imports (supplies) – such as raw material (including potential impacts on biodiversity). That being said, it is not clear whether this could lead to research, as there are mostly procedural recommendations, reinforcing existing procedures, and rules, and legislation, or facilitating access to competent researchers, associations and specialists, in order to do these assessments.

The initial hypothesis could also apply to companies in the Southern hemisphere (or generally, developing countries), where they may see the economic advantage of recognizing and supporting ecological engineering. This could be particularly true of the public sector's development aid programs, such as USAID's, CARPE and Wula Naafa programs (in Senegal) that are aimed at artisans and small farmers, in the goal of sustainable exploitation of naturally occurring tree species. To be more effective, such programs should invest more in raising awareness and education for all the private sector intermediaries and stakeholders.

Ecological engineering within industries, and industries within ecological engineering: ethics, design, impact and remediation

Frédéric Gosselin, Cemagref, France

Industries today are getting greener and greener - partly in their communication, partly as a true strategy. I wish to open a discussion on the ways in which 'ecological engineering' and ecological engineers could be useful to industries and firms in their 'Green (R)evolution'.

Firstly, ecological engineering already exists within some industries: such as in the various impact assessments required by various laws and regulations. Some of you might not agree that impact assessment is part of ecological engineering, but I have the opposite point of view (Gosselin, 2008). This is an area that is very much active - both in practice and in research.

Secondly, industries have developed activities that incorporate ecology within the firm, or very close to it. The part of ecology that is used most often here is ecosystem-level, functionalist ecology (Callicott et al., 1999) and it is mainly used in designing new machines or processes - one of the core activities of engineers. This has generated a whole set of new design concepts - The Natural Step, Biomimicry, Getting to zero waste, Resilience Engineering, Ecological Design, Green Chemistry, Self-Assembly, etc. Some of them belong to Industrial Ecology. This area is also very active and I have no suggestions here, other than proposing that industrial ecology should be part of ecological engineering (Gosselin, 2008).

Thirdly, there is the idea that industries and the engineers working for them should be more considerate towards humanity and the living world (e.g. Lau, 2004). This indeed is already one of the focuses of impact assessments (cf. above). Yet, I find that one thing that is lacking here in most situations is that impact assessments are made site by site, whereas I think that it is possible to yield richer information if part of the assessments were carried out in a collective/network fashion. Especially to better apprehend the positive or negative impact of a generic industrial activity on living entities - the compositionalist side of ecology (Callicott et al., 1999). I propose that multi-site monitoring, and potentially experiments, are more informative than a repetition of site by site assessments. This is because compositionalist ecology is usually characterized by higher levels of spatial variability and uncertainty about the outcomes than functionalist ecology. This multi-site approach seems to be already

applied in the context of remediation after mines have closed. Of course, industries are not the only proponents of such a change: laws, politicians, scientists, citizens should also be involved, but they could contribute to it, which could be part of a wider biodiversity monitoring system.

Lastly, associated with the eco-responsibility of industries and engineers, there is a need for a firmer ethical ground for ecological engineers, which could be included in the training of engineers.

On reading this contribution, you will surely find that these proposals reflect my inexperience with industries, and you will be right. I only hope that it provokes the start of an interesting discussion to identify the many points I have missed on which ecological research and engineering could be developed in industries.

Is greater biodiversity always better?

This contribution considers if greater biodiversity always leads to higher sustainability, higher primary production or higher stability in ecosystems. The author also highlights the potential profits to be gained from investigating the functional consequence of genetic diversity within populations and the use of this in ecological engineering to increase crop yield.

Sébastien Barot, Biosol, Bondy, France

While the link between biodiversity and ecosystem functioning is well recognized the underlying mechanisms are not well identified and it is not that clear to me that more biodiversity is always better in achieving higher sustainability, higher primary production or higher stability. While some results suggest that increasing plant diversity can increase plant primary production (PP), it could often be due to a "sampling effect" and the fact that incorporating more species makes it more likely to incorporate a highly productive species such as a legume. Moreover, the links between belowground and aboveground biodiversity seem to be less clear and more idiosyncratic than the links between plant diversity and primary production.
Nevertheless, it is clear that the identity of species composing a community and the interactions linking them is of paramount importance for ecosystem properties (mean PP, PP stability). This means, in the context of ecological engineering, that choosing the right species or the right assemblage of species is primordial to increase the productivity of a field (or any type of animal breeding) or the sustainability of its productivity. Since increasing biodiversity systematically is probably not always profitable (see above) and not always feasible, this is probably tricky and new procedures to select the assemblages of species we want to use to provide particular ecosystem services are needed.

Already developed agricultural practices, such as rotations and intercropping, are based on the use of biodiversity. But systematic empirical procedures to select assemblages of species, as well as new theories, are required to optimize the species assemblages we want to maintain for particular purposes. These procedures should primarily be based on the known existence of positive interactions between the species. These procedures should also involve a kind of group selection. While natural selection increases the capacity of individuals to reproduce, it does not necessarily increase the collective capacity of a population (a field for example) to provide services such as PP. Artificial selection such as the selection of crop cultivars is thus

based on group selection, but acknowledging this fact could foster the development of more profitable cultivars. Moreover, human-designed group selection could also involve the selection of a group of species: mixtures of plant species, plant species together with their soil-dwelling symbionts, etc. In turn, this could involve both the choice of existing species and the breeding of new species through selection procedures.

Moreover, while the functional role of species richness has already been widely investigated, the functional consequence of genetic diversity within populations is an entirely open area of investigation. This could be investigated in natural communities but could also be used in ecological engineering to increase crop yield. Mixtures of crop varieties are already cultivated but are not quantitatively important. New procedures to choose assemblages of varieties and to select varieties within these assemblages could thus be profitable. However, this would require a more profound knowledge of the functional importance of genetic diversity within and between functional groups (primary producers, decomposers, nitrogen fixing bacteria, pests, etc).

RE: Is greater biodiversity always better?

Jari Lyytimäki, Finnish Environment Institute, Finland

Ecosystem disservices are important for ecological engineering

Sébastien Barot presented an important question: "Is greater biodiversity always better?" I would like to provide an alternative perspective that might be relevant when we are seeking answers to this question, in addition to insights already presented.

The role of biodiversity as a fundamental basis of ecosystem services is widely acknowledged. However, in my opinion, the role of biodiversity as a producer of so called ecosystem disservices should be acknowledged as well.

Ecosystem disservices can be defined as functions of ecosystems (or biodiversity) that are perceived as negative for human well-being. The importance of these disservices, or "bads" is likely to become more important both because of environmental changes and changes in human lifestyles (see Lyytimäki et al. 2008). To put it shortly, sometimes greater biodiversity means, for example, new nuisance species or growth of abundance of native species causing harm to people.

My point is a simple one, but perhaps a neglected one: Ecological engineering should focus on biodiversity as a provider of both ecosystem services and disservices.

Biodiversity conservation at business sites: connecting theory with practice

Robbert Snep, Alterra - Wageningen UR, The Netherlands

At Wageningen University and Research Centre a 4-year study was recently undertaken to explore the options and opportunities for biodiversity conservation at business parks and districts, and industrial estates and ports. Findings from this study were directly implemented in business site development cases, thereby closely cooperating with project developers, (landscape) architects, municipalities and (environmental) NGO's. This illustrates that the gap between theory and practice in ecological engineering can be bridged, if one is willing to be flexible and place oneself in the position of the other.

Context:

In the discussion about what industry can do for ecology the options and opportunities that business sites (the specific areas where companies are settled) offer for biodiversity conservation are not yet addressed. In the highly populated Netherlands space in scarce and innovative land use concepts are in demand to integrate the interests of People, Planet and Profit, especially in urban areas. Current business sites can thereby be considered as highly mono-functional (focused on economic activities), and with a design, management and use unconnected with the surrounding landscape. Here, there is a lot that ecological engineering can offer to make business sites contribute to the neighbouring biodiversity and landscape values.

The Research:

Researchers at Wageningen UR have, in 2004-2008, conducted a series of explorative studies to investigate what biodiversity levels can be observed at current business sites, what potential these areas offer for biodiversity conservation and how this may be appreciated by business site stakeholders. At current sites breeding birds and amphibians were studied, and conservation strategies developed (see e.g. Snep & Ottburg, Landscape Ecology, in press). To explore how business sites may contribute better to biodiversity conservation, the function of the business site as a peri-urban source for inner-city nature (Snep et al., 2006) and for conservation of surrounding ecological networks was explored. In addition, various design and management options were compared in a MCA-study, in which stakeholders (companies, employees, municipalities, neighbouring citizens and environmental NGO's) ranked the options based on their preferences for the different socioeconomic and environmental characteristics of the business site options. (This series of studies will

be published in a PhD-dissertation by Robbert Snep in February 2009.)

The Practice:

Recently, there is an increasing demand for insights into how ecological values can be integrated in the urban environment. In the case of the redevelopment of the Dutch Tax Department offices in the city of Groningen, the high biodiversity levels (endangered bat and bird species) at the urban forest adjacent to the office site made the municipality insist that developers include specific measures for biodiversity conservation in their designs. By implementing findings of the research mentioned above, an office site design was developed in which the modern buildings offer nesting opportunities for bats (a specifically adapted room in the building) and the urban green at the site will combine aesthetical values with ecological functions (e.g. butterfly garden, semi-ecological bodies of water). The buildings were also shaped such that wind pressure on the adjacent forest was minimal, and groundwater-flows comparable with the original situation. This biodiversity-included design was chosen as the winning design.

What can we Learn?

Implementing scientific knowledge in practice requires us to be able to switch from theoretical concepts to real-life situations, thereby coping with different 'languages' and 'ways of working'. It asks for a pragmatic approach and common sense for addressing the knowledge in an engineering context. Architects ask for specific guidelines for construction, no vague concepts. Also, the role and involvement of the researchers in the development process is vital. Good arguments are needed to convince developers and architects in an early stage of design why certain measures should be taken, thereby proposing the measures such that they fit within the overall picture of the site. In the Groningen case this meant designing a bat-room such that bats will be attracted to the location, but also the appearance of the room fits within the building's design. With more and more companies and municipalities interested in contributing to biodiversity conservation, ecological engineering seems a promising direction, if (ecological) researchers are willing to integrate their knowledge in the engineering world.

Is ecological engineering ecological?

Ferdinando Boero, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali), University of Salento, Italy

I have not followed the discussion much, but I liked this summary. In Italy, ecological engineering is taught in the faculty of engineering and, in most curricula, there is no ecology. These ecological engineers manipulate a system (the environment) while ignoring its structure and function (ecology). Would you allow a medical doctor to operate on you while ignoring anatomy and physiology?

If you travel along the Adriatic coast of Italy by train, you will see the great Adriatic wall. It is 500 km long. It is made by coastal defences; you can see them with google earth, built by engineers to cope with coastal erosion. Beaches are removed by waves because engineers build houses and infrasctructures right on the shore and then the problem is solved by building a wall, transforming a soft bottom into a hard bottom. Of course a hard bottom is less eroded than a soft one, but is this a solution? The environment has been changed drastically, first with development, and then with a solution that cures the symptoms but not the causes.

Of course a higher biological diversity is not always good. Non indigenous species make species lists longer. There are no instances, in the sea (the domain I study) of a local extinction deriving from the arrival of a newcomer, but this does not mean that more and more species will make systems function better. Co-evolution makes systems work better. Not simple species addition. Knowing ecology and evolutionary biology makes this obvious. Do ecological engineers know about ecology and evolutionary biology? Can we dream of improving a system without knowing how it works and what are its components? We are doing exactly this.

The promises are exceptional, the outcomes are less exceptional. It is the same with finance. They promised heaven, and now we are in hell. The first thing we do to cope with the crisis is to cut resources for the environment.

There are too many compartments in all these disciplines, and ecology is the science of interactions. Engineers have a role: provide solutions. Scientists have another role: identify problems. The two have to work together. The solutions of engineers are often short-term ones, and this can cause greater problems and the scientists who warn about this are seen as a nuisance. Who is called to solve these new problems?

Engineers, of course.

In the Adriatic they are now proposing to remove the wall and to inject deep sand to reconstruct the old beaches. The wall is finished, now they have to invent another problem to continue to work. So the wall is being dismantled. The solution is another one: retreat. But politicians do not like it. So new magic solutions are proposed, and those who warn about problems are labelled as Cassandras. There is one detail, though: Cassandra was right.

Ecological engineering – learning from the past

Felicita Scapini, Department of Evolutionary Biology, University of Florence, Italy

Key points:

- Learning from past experience in ecological engineering
- Biodiversity has various levels of integration
- The dynamism of ecosystems and adaptation of organisms as value

Organic agriculture and cattle breeding derive many of their principles and practices from traditions and past experience. In a similar way ecological engineering has a long history, surely dating back from the Roman times, e.g., the plantation of pine woods to stabilize coastlines, the management of rivers to prevent floods, land reclamation for agriculture, land flooding for rice cultivation, land irrigation, introduction of crops, digging of water reservoirs, etc… There is no landscape or ecosystem around the Mediterranean that has not experienced such ecological engineering in the past.

Ecological engineering as a new discipline should select a number of case studies to build a background for future developments and actions. Any conservation and restoration project should take into account past experiences to prevent the replication of errors. Analyzing the history of transformations of the ecosystems would also help in estimating their resilience.

In the course of the WADI project (INCT-CT2005-015226), focused on water needs and uses in the Mediterranean coastal zone, we have analyzed a number of case studies in Italy, Spain, Morocco, Tunisia and Egypt (www.wadi.unifi.it). Throughout historical times, each of these sites has incurred ecological modifications and has become such as it is now through anthropogenic modifications. All sites analyzed include a rich biodiversity at different levels of integration and provide goods and services to the people living in the area. However, they are threatened by recent rapid developments. For example, in the Maremma Regional Park in southern Tuscany the sandy coastline has been subject to several modifications throughout time, pulsing from erosion to accretion, in dependence on managements and activities outside the area (upstream the river basin and in the agricultural land backing the dunes). Nevertheless, the beach-dune ecosystems show natural features and adaptation at all integration levels (community, species, population, life cycle, physiology, behaviour, genes). Now the regional managers have decided to stop the erosion of the coastline

and protect the area backing the beach by means of engineering measures, eventually accompanied by beach-dune restoration. However, the past experience has taught us about the value of the dynamics of the coastline system – why should we apply measures to stop natural dynamics? The timing and relationships of changes in this system throughout time would teach possible strategies of beach restoration in other sites. The risk of restoring dead systems instead of living ecosystems is high and managers should be cautious. Regarding biodiversity, this is a synthetic concept that includes diversity at various levels of integration of life. Species diversity is a proxy of biodiversity that ranges from genes to communities and ecosystems. Adaptation and maladaptation would be useful concepts in ecological engineering. The adaptation of native species (acquired throughout evolutionary times) would be a value to protect more opportunistic alien species.

Ecological engineering: a task force in favour of biodiversity

Patrice Valantin, Dervenn, France

This contribution from the Association of Ecological Engineering outlines a brief analysis of the development of business in ecological engineering. The association includes companies (Dervenn, Scop Sagne…) involved in a process of biodiversity conservation and management that are able to carry out both surveys and operational actions in France. The analysis underlines the lack of specialized operators that could be contracted by actors from the public and the private sectors to implement concrete solutions in favour of biodiversity. The author asks for an engagement of new operators to develop this new business and for the participation of multidisciplinary professionals to structure the profession (validation of methods by scientists, control by an independent organization...)

Framework

Today in France, the trades of biodiversity show an imbalance, with numerous scientists and consultant engineer departments involved in this field but there are almost no companies for technical operations. Actions are consequently carried out by professionals in forestry, agriculture or landscape gardening. They could often use the same tools but purposes, constraints and requirements are very different. The situation leads to a lack of skills for works specialized in natural systems. Moreover, the multiplicity of actors and laws makes the implementation of actions more complicated as operators have to resolve many problems that are remote from biodiversity issues.

Operational solutions

Thus, conservation of biodiversity requires a task force able to implement appropriate actions and operational solutions in support of biodiversity. This task force would be made up of companies specialized in ecological engineering whose jobs would be to restore, build and create natural infrastructures (habitats, corridors…) for non-human living populations. Services offered by these companies must cover the whole process, from surveying sites to monitoring and long-term management. This new kind of corporation includes all skills from workers to ecological engineers.

Technical and ethical constraints

One of the aims of the Association of Ecological Engineering is to structure the profession with referenced companies that respect the technical and ethical considerations outlined in its charter.

As companies manipulate the components of natural systems, their activities must be strictly controlled and regulated. A control organization must be constituted to set standards for methods and operational techniques, standards of performance or frames of reference and control, and to ensure the scientific, technical and ethical foundations of actions are prescribed and implemented. It would guarantee a true transparency for the clients who wish to get involved in a project of biodiversity recovery on their territory. It will reduce the risk of drift related to a new market following the application of the law on environmental responsibility. It will also help as to check the use of public and private money engaged in mechanisms of statutory compensation.

Integration in the market economy

Integrating biodiversity into the market economy is one of the means to give it back a true value when services of quality that allow a significant return on investment are offered. The question is no longer to only conform to statutory constraints, but also to produce a real gain coming from these actions. It applies to companies that will have a positive return in terms of image, but also to the owners of private properties who wish to preserve and increase the patrimonial value of their territory. The creation of specialized companies will naturally induce a market since they will have to communicate on the added value of their services. It will increase the money invested in favour of biodiversity, both public money and private capital. Activities will apply to the whole national territory, both public and private areas, allowing an effective ecological continuum. Furthermore, this task force in support of biodiversity can also be a good interlocutor privileged with the patrons and foundations that can be in deficit of concrete projects in this field.

Social implications

Ecological engineering tends to favour manual intervention rather than mechanical actions in order to minimize residual impacts on ecosystems. The development of ecological engineering is thus a great opportunity for creating new qualified jobs for people without pre-qualification education and people excluded from the job market. It will require the creation of specialized training centres which do not exist to date. Indeed, the existing training does not focus on methods and techniques adapted to interventions on ecosystems and natural habitats as education is provided in forester, rural, landscape or agricultural training.

Development of an ecological engineering business

Members of the Association of Ecological Engineering work on the design of scientific protocols and technical methods to implement pertinent and effective

actions in restoration and creation of natural systems. These solutions must be planned in the long term, which generally exceeds the economic time-scale. Thus, the organization of the profession and the development of a regulated business also requires the participation of other actors, such as scientists, lawyers, decision makers or managers, to validate the protocols or to define the statutory framework of actions.

Session III: How to integrate biodiversity in company strategies; experiences and best practices

Introduction to Session III: How can we integrate biodiversity into company strategies? Experiences and best practices

Joël Houdet, Orée – Entreprises, Territoires et Environnement, France

At its eighth meeting in March 2006 at Curitiba, the Conference of the Parties to the Convention on Biological Diversity reiterated the importance of engaging the business community in the implementation of the Convention. Decision VIII/17 (http://www.cbd.int/decisions/?m=COP-08&id=11031&lg=0) covers:
"The engagement of Parties with the business community when developing and implementing national biodiversity strategies and action plans; the participation of business in Convention processes; the compilation, dissemination and strengthening of the 'business case' for biodiversity; and the compilation and development of good biodiversity practice".
Decision IX/26 adopted at COP-9 of the CBD in 2008 in Bonn further stressed the need for the continued development and promotion of the business case for biodiversity and the dissemination of best practice.

Business engagement for Biodiversity and Ecosystem Services (BES) concerns a wide array of themes, including payments for ecosystem services, biodiversity offsets, biotechnologies, agro-fuels, certification schemes, public and private procurement policies and even mobilizing the financial services sector. At COP-9, Parties also agreed "on a firm process toward the establishment of international rules on access to genetic resources and the equitable sharing of benefits from their use".

Various tools and methodologies have been proposed and tested so as to analyze and classify risks and opportunities that BES loss would represent for businesses. Reputation, modes of regulation, access to and cost of raw materials and capital have been recurrently mentioned as key issues which companies' should be concerned with. Understanding that their operations, sales and income and survival are intrinsically dependent on BES, companies worldwide have begun to assess their impacts on biodiversity and develop innovative partnerships for their mitigation.

How do companies take account of their interactions with biodiversity? Through case studies and best practices, what can be learned from the integration of biodiversity into business strategies? What implications are there for decision-making, operations management and reporting? What conceptual and practical tools should be developed, promoted and shared by all stakeholders?

Case Study: Veolia Environment

This contribution outlines an example of how Veolia Environment contributes towards the conservation of biodiversity rich land by the maintenance and development of diverse habitats for a variety of fauna and flora. The author highlights the benefits of these conservation efforts for the business' outputs.

Mathieu Tolian, Veolia Environment, France

In response to the major issue of biodiversity protection, Veolia has:

- Integrated biodiversity in the first commitment of its Sustainable Development Charter,
- Since 2004 developed an approach based on characterizing the impact of its activities and implementing integrated management into its Environmental Management System.

The most recent work led the Company to reflect on the nature of the relationship between its activities and the living world, beyond the simple consideration of impact.

Through its activities (primarily treatment of waste and wastewater), Veolia seeks to reduce the polluting load which weighs on ecosystems. Today, treating the pollution contained in water or waste often involves biological processes that rely upon micro-organisms. The Company thus depends on the living world to perform its business activities.

Nevertheless, these activities have a secondary impact related to the residual pollution contained in discharge. Although the solutions for controlling this impact still require a significant development of expertise, it is possible that for technical or economic reasons the solution consists of relying more on ecosystemic functions.

For example, Veolia Eau operates the drinking water production site at Crépieux-Charmy (Grand Lyon). France's largest catchment area with a surface of 375 hectares, this site is unique in its biodiversity and its significance is recognized by its inclusion in several scientific inventories (ZNIEFF, Natura 2000, etc.).
In order to preserve the exceptional character of this site, Veolia Eau joined with the Lyon Urban Community and local environmental associations to monitor, restore and maintain the site's ecological heritage as part of a five-year site management plan.

A team of five people charged with taking care and maintaining the site ensures ecological monitoring at the site with the regular support of experts from local nature preservation associations (FRAPNA, CORA). Notably, the team takes inventories of the fauna and flora and thus contributes to the enrichment of scientific knowledge. Moreover, it maintains and develops diverse habitats including the creation and remodelling of ponds for amphibians, restoration of bushy habitats for nesting birds and autumn mowing of meadows with limited maintenance around catchment wells.

These actions, by supporting the preservation of biodiversity, contribute to the protection of the water resource and thus facilitate the exercise of our business activities.

Thus, all of these elements lead us today to reflect on the evolution of our core business towards the integrated management of our industrial facilities and the ecosystems of which they are a part.

To this end, the need for expertise in terms of ecosystem management remains important and the development of ecosystem modelling will be an asset in order to better understand ecosystem complexity and to anticipate the changes which ecosystems undergo.

The business and biodiversity initiative

This contribution outlines the challenges involved in integrating biodiversity into business strategies.

Nicolas Bertrand, Convention on Biological Diversity, Quebec, Canada

For some companies, the linkages with biodiversity and ecosystem services appear more straightforward than for others depending, for instance, on the sector of activity and the position in the supply chain – ultimately, though, "biodiversity is everywhere and it is everyone's business", as has been mentioned before.

Over the years, the business and biodiversity community has invested significant energy in addressing three issues: (1) how to get biodiversity into 'mainstream' business; (2) how to create effective and equitable biodiversity markets; (3) how to promote 'biodiversity businesses' (this typology is more for illustrative purposes, as these issues are at times intertwined).

Discussions on the role of business in addressing the current biodiversity challenge have also taken place at the international policy level. For instance, Parties to the CBD adopted in 2006 the first decision to focus exclusively on business engagement (although it should be noted that the role of business is recognized in the Convention Text itself as well as in many decisions adopted by Parties over the years). 'Business and biodiversity' has also recently been on the agenda of other policy forums, such as the G8.

On a more general note, a number of initiatives in related sustainable development fields of enquiry, e.g. corporate (social) responsibility, sustainability reporting, corporate environmental research, social entrepreneurship, partnership building, etc., are also highly relevant.

Whilst there has been, undoubtedly, progress in addressing all three aforementioned issues (e.g. individual companies have adopted corporate policies; best practice guidance has been developed in a number of sectors; tools have been elaborated to better assess company dependencies on biodiversity; multi-sectoral platforms have emerged to look for common solutions; etc…), several challenges remain. These include:

1. Making the business case for biodiversity. It is often difficult for the business community to relate to the way the biodiversity challenge is framed. There is a need for “speaking a common language”.

2. Getting small companies on board. Most of the business and biodiversity ‘toolkit’ is currently geared at larger companies. This is an issue, as most companies around the world are SMEs (small and medium enterprises).

3. Going beyond individual examples. There are many noteworthy and promising ‘stories’ on business and biodiversity, but it is not always clear how representative these are of an organization’s overall commitment to / impact on biodiversity.

4. Expanding the business and biodiversity landscape. The business and biodiversity community would benefit from inviting actors from sectors, markets and regions which have been typically under-represented to join the discussions. In this regard, a far greater role could be envisaged from business schools and professional services firms.

RE: The business and biodiversity initiative

Martin Sharman, European Commission, Belgium

Nicolas Bertrand presents a useful analysis of steps that must be taken if biodiversity is to be integrated into business strategies. But once again I want to stress the obvious. It is not so much a matter of integrating biodiversity, whatever that means. It is more a matter of integrating what Nicolas calls "the biodiversity challenge" - and again, that probably means something quite different to each of us.

The crux of the matter is to find ways to make a business case out of protecting, conserving, and cherishing the diversity of life. How can looking after life on Earth actually help a business to survive in a competitive world? Using biodiversity to make money is one thing - we're good at that - but it is quite another to use biodiversity sustainably to make money, while not inadvertently running down other elements of biodiversity through some unintended side-effect.

So for me, it's unfortunately not as simple as "making the business case for biodiversity". And it's more than just "speaking a common language", however necessary that is. It is also making a business case for doing good to the living world, where "good" is a rather complex and knotty concept.

RE: The business and biodiversity initiative
The business and biodiversity initiative in Russia

Vladimir Vershinin, Institute of Plant and Animal Ecology, RAS Ural division, Ekaterinburg, Russia

It is possible to say that in the Russian Federation new effective mechanisms for biodiversity conservation are still under construction. Some Russian companies declared their environmental policy as a conception that corresponds to the requirements of sustainable development and means minimization of environmental pollution and disturbance, use of ecologically "clean" technologies, and environmental restoration if it were disturbed etc.

They actively support principles of the Charter "Business and steady development" developed by the International trade chamber, and "Code of the Responsibility" accepted by the chemical industry. For example, the following companies support these principles:
RAO Gazprom, corporations PROMEC-HOLDING, OAO Symbol, Octel Company, Akzo Nobel Company, and FIAT Company (http://www.14000.ru/books/voluntary/app1.html).
In reality it mostly looks like the principles entail restoration measures after disturbance, pollution, and accidents under the supervision of the Federal service.
There are also some ideas in private business involvement in biodiversity conservation or mitigation, but only in the form of pilot projects or protocols on intentions that have just been proposed: http://www.biodat.ru/db/mon/history.htm, http://www.sci.aha.ru/ARC/C4.htm

On the 20th of December 2004 a round table meeting was held in The World Bank in Moscow, entitled "Ecological ratings as systems of an estimation of efficiency of activity of the companies in Russia", that was organized by the International social-ecological union (http://www.seu.ru/about http://www.seu.ru/documents/manifest.htm) and Independent ecological rating agency.

The representatives of the companies mentioned below have taken part in work of the round table:
RAO Gazprom, Surgutneftegas, LUKOIL, The Petroleum Company UKOS, Gorky car factory, Nizhnekamskneftekhim, Nizhny Tagil metallurgical factory, TVEL, UEC of Russia, Rosneft, SUAL HOLDING, Uralvagonzavod, Apatit, GROUP CHTPF, Akron, Lebedinky MTC, news agency AK&M, ratings agencies Price Waterhouse Coopers and Ernst & Young, and also the Ministry of economic development and trade of Russia.
They have decided that - "businesses should favourably be ecologically responsible"… Four years on since the declaration was passed and very little has changed. In Russia we need strong, effective economical and administrative mechanisms to "push" business into the necessary channels for effective initiatives in the field of biodiversity conservation.

RE: The business and biodiversity initiative

Joël Houdet, Orée – Entreprises, Territoires et Environnement, CREED, AgroParisTech; Paris, France.

In response to the comments of both Martin Sharman & Vladimir Vershinin (with respect to Nicolas Bertrand's well-argued contribution), it seems that we are approaching the question of whether or not voluntary measures by business would be sufficient to ensure the viability of biodiversity.

How can businesses go beyond marketing opportunities that arise from best practices with respect to biodiversity (i.e. the resulting niche markets may not last...)? Do we need industry-wide voluntary instruments or standards? New market mechanisms? New regulations or mandatory standards? "Biodiversity foot-print" labels on every product sold, as proposed for food products by Yann Maubras & Hélène Leriche in another contribution to session 3? Maybe, we need a mix of everything?

I would argue that the crunch of the debate has to do with the way we measure the ecosystemic performance of organisations (as well as that of goods and services), that is, the way we account for the interactions between businesses and biodiversity (Houdet, 2008).

In response to the global financial and economic crisis which is currently unfolding, we risk seeing a new "Bretton Woods" founded on (old) economic models that would further homogenise biodiversity, so that "economic" growth resumes.
Though risk free in the short-term for global finance which can play with risk mitigation tools, the socio-ecological consequences will most likely be irreversible for future generations: i.e. the ones, who will work, save money for their retirement and children, invest, do business; all in close relationship with financial institutions...

We must make sure that this will not happen: this crisis is a major opportunity for the integration of the economy into biodiversity.

RE: The business and biodiversity initiative

Peter Petoik, Institute of Botany, Academy of Sciences, Czech Republic

Practical and theoretical obstacles of impact assessments and integration of biodiversity related to industry and business are summarized in the BioStrat review for the Czech Republic (see Petøík et al. 2008a). The results from various biodiversity studies are only rarely linked to Czech business and industrial practices and insufficiently acknowledged by policy- and decision-makers in this sector. Some steps to change this are recommended.

Biodiversity in the Czech Republic has been reduced significantly as a result of non-environmentally friendly industry and forest and agricultural management during the last several decades. After the political changes in 1989, the industry in the Czech Republic was structurally transformed, contributing less to the environmental degradation.

The Act on Environmental Impact Assessment defines that both projects (i.e. EIA) and concepts (i.e. SEA, i.e. plans, programmes, policies and other strategic documents) which are likely to have impacts to fauna and flora, ecosystems, natural resources, landscape, and cultural heritage have to be a subject of the appropriate assessment. However, neither biodiversity nor other environmental component risks are evaluated from the economical/financial point of view within the EIA/SEA processes in the Czech Republic.

Theoretically, the purpose of the assessment (EIA and SEA) is to provide objective and transparent information on the anticipated environmental effects of the

project/plan for decision-makers. Teamwork of biologists and technologists, and even economists and social scientists, is a prerequisite. Public debate is usually understood as an essential component of the impact assessment process. The decision-makers have to consider results, but they are not obliged to follow them – i.e. the project/plan with adverse environmental effects can be approved, but with a mandatory explanation of why the results of the assessment have not been included in the decision.

There are some key weaknesses of impact assessment practice in the Czech Republic (see Smutny et al. 2005):

1. Low emphasis on primary goal of the assessment i.e. to ensure the project/concept is implemented in accordance with requirements for environmental protection. This could be due to the existence of "two cultures" (technological and biological) with various methodologies and values, however, some interdisciplinary methods are arising such as, for instance, the equivalency analysis including approaches (e.g. remediation) to determine type and range of natural resources and losses of ecosystem services as a consequence of environmental damage (see Boháè 2008 and project REMEDE);
2. Low impact of the assessment on the final project/concept implementation with insufficient monitoring and lack of capacities for these activities. This could be due to the complexity of ecosystems, difficult measurability (choice of indicators) and complex impact of technology (cumulative and synergy effects) – response of ecosystems is delayed and non-linear. Further, cost-benefit analysis or the valuation of ecosystem services is complicated and not easily applicable to biodiversity (economic approach has limits, but we especially lack the monetary estimates of non-marketed ecosystem components);
3. Alternatives are often insufficiently considered and there is an absence on the consensus of how to apply a precautionary principle.

The Ministry of the Environment has adopted Methodology for Environmental Management Accounting. Companies operate with environmental credits and debits in Methodology of Accounting and measure and monitor identified pollutant emissions following the operation permits of Integrated Prevention and Pollution

Control (IPPC). Some companies operate installations utilizing the best available technologies, having contingency plans and training for extraordinary/emergency situations that may occur. However, despite the increasing accountability of businesses towards sustainable development, companies are not motivated to include biological diversity into their accounts and concerns. One of the ways to make biodiversity interesting for industries is to introduce "biodiversity credits". These credits would be tradable permits designed for the market exchange and devised from the impact assessment of industries´ impacts on biodiversity (see also Bekessy & Wintle 2008).

To sum up, the results from various biodiversity studies are only rarely linked to conservation practices and insufficiently acknowledged by policy and decision-makers in the Czech Republic. To change this paradigm of strictly benefit-orientated industry towards sustainable management, the most important scientific and practical steps have been recognized (see also Drhová et al. 2006, Petøík et al. 2007, 2008a):

1. Knowledge of the initial condition of remediated habitat is crucial if consensus about desirable future status is to be achieved in impact assessments. There are many systems and approaches, which are not integrated in the framework of land-use planning and management plans of companies. Some cost-benefit analysis or the valuation of ecosystem services is easily applicable to biodiversity units as needed. Use of resource equivalency methods in enabling assessment of environmental impacts and remediation options could be solution.

2. Despite various systems of monitoring and indicating biodiversity changes (see Vaèkáø 2005), the outcomes of long-term monitoring are not fully integrated in the framework of business and companies' management (particularly the delay of ecosystem on changes). Hence, both the integration of appropriate biodiversity indicators into business and harmonisation of monitoring systems are needed.

3. There is no training system in education for the economic dimensions of biodiversity (employees of the State Administration, representatives of local governments, managers and decision-makers in agricultural, and SEA/EIA assessors). Thus, revision of the methodical instruction for EIA assessors would be recommended, taking into account the requirements of biodiversity-related issues and their training.

RE: The business and biodiversity initiative

Biodiversity and companies: regulations and experience in Lithuania

Anna Budriene and **Eduardas Budrys**, Institute of Ecology of Vilnius University, Lithuania

The contribution includes a brief review of the national regulations concerning the impact of company activities on biodiversity and the available experience in Lithuania

The Lithuanian national legislation system includes several laws concerning biodiversity and the impacts of company activities on it. One of them is the Law of the environmental impact assessment for planned economic activities, including the potential impact on biodiversity. The assessment is obligatory for some activities in industry (digging, energy production, metal, mineral and chemical industry, wood and paper industry), agriculture, infrastructures, constructions related to radioactive waste etc., if their scale exceeds the established limits. In selected cases, the environmental impact assessment is also required for the intensification of agriculture, clean cut of forest or deforestation, if they include the change of land use, aquaculture, and some other activities. The Law of wildlife directly obliges the legal bodies and persons developing any projects connected with land, forest and water use to ensure that their activities have no negative effects on the populations of wild animals, their habitats or migration routes. According to the Law of protected animals, plants and fungi and their communities, the land and forest owners may receive compensation from the state budget as reimbursements for losses related to the organization of protection of the endangered species and communities.

The government stimulates companies to apply environmentally friendly management schemes, which also presume the decrease or the mitigation of impacts on biodiversity. For small and medium-size enterprises, the Ministry of Economy reimburses 75% of the international Eco-Management and Audit Scheme (EMAS) certification costs and 50% for the ISO 14001 certification costs. In April 2007, there were 267 companies with implemented environmental management systems in Lithuania. A few of them satisfied the ISO 14001 standards. However, none of the Lithuanian companies have got the EMAS certificate so far.

Few larger (in the scale of Lithuania) companies may be mentioned here as examples of minimizing impacts on the environment, including the impact on biodiversity. “Achema” is the largest fertilizer producing company in the Baltic States. It was

awarded the 'most environmentally-friendly process' prize for the implementation of a zero-waste technology. "Achema" has been declared as one of the top ten chemical companies in the EU having the lowest pollution per unit of product indicators. It was also one of the first Lithuanian companies to gain an Integrated Pollution Prevention and Control (IPPC) permit.

One of the largest textiles and clothing company, "Utenos trikotazas", also reduced their environmental impact to acquire the ISO 14001 certificate. Another company with an implemented ISO 14001 certification is the office furniture producer "Narbutas & Ko". It declares that its supplier selection always includes the demand of the sustainable forestry certificate. Vilnius State Forest Enterprise (VSFE) is an example of stakeholder engagement in environment and biodiversity protection. The VSFE provides qualification improvement courses for the forestry employees, offering free of charge consulting for the private forest owners and encouraging a sustainable, biodiversity-oriented forestry. It collaborates with the forest owners' associations, Lithuanian Ornithological Society, Lithuanian Green Movement and other NGOs, maintaining an information system with a library on sustainable forestry and promoting environmental awareness.

Although the legislation system of Lithuania includes several regulations directly aimed at biodiversity conservation, the activities of most private companies are usually directed towards the general safety of the environment, particularly towards reducing pollution and waste disposal. Initiatives and commitments directly focusing on biodiversity are rare exceptions.

RE: The business and biodiversity initiative
Biodiversity and companies - Portugal

Marina Pereira Silva and **Isabel Sousa Pinto**, CIMAR - Centre of Marine & Environmental Research, Portugal

Review on the Portuguese Business and Biodiversity initiative

Halting or substantially decreasing the loss of biodiversity by 2010 was agreed by EU member states in 2001 and CBD parties in 2002. This goal is a truly global challenge to which different actors around the globe should respond to in different ways and according to their capacities and priorities. The effort has to be shared between government institutions, NGOs, the general public and private companies. Several

initiatives started to link explicitly biodiversity loss and economic loss (e.g. TEEB) and businesses are becoming aware of their responsibilities and potential role in the conservation of biodiversity and sustainable use of its components, launching different initiatives like the Business and Biodiversity Initiative.

In 2007, Portugal launched a Business & Biodiversity initiative aiming to involve the Portuguese companies in the global effort to stop the loss of biodiversity until 2010 and beyond. The Portuguese Business & Biodiversity initiative is managed by the ICNB (Institute for Nature Conservation and Biodiversity), and is voluntary. Each company commits itself to evaluate the impact of its activity on biodiversity and to improve its management to decrease this impact. The process and the commitments must be public, and the ICNB is responsible to secure the transparency. The adhesion begins with the production of a document by the company/organization that summarizes its history, sector of activity, policy for biodiversity and the type of agreement that it intends to adopt and is formalized with the signature of a memorandum of understanding (Commitment to Biodiversity) by the responsible company/organization and the President of the ICNB.

Since 2007, the Portuguese B&B initiative has already 41 companies and organizations from different sectors of activities: from agriculture and forest to port and airport administrations, including the financial sector, energy and water companies, mining and construction sector and the tourism sector (see annex 1). In order to assess the implementation level of the commitments signed with ICNB we sent a questionnaire to each company/organization adherent to the Portuguese B&B initiative and we also collected data from the internet. So far we have received 18 answers (43, 90%) to the questionnaire and the preliminary results are listed in annex 2.

The main actions at present can be included in one of four categories:

1. Identification, minimization and monitoring of the impact of the company activity on biodiversity
2. Projects to increase awareness on biodiversity
3. Projects for conservation and restoration of biodiversity and habitats
4. Research projects on biodiversity

The Portuguese companies involved in B&B recognize that the conservation of biodiversity is important to their core business. This is why they pledge not only to identify and reduce the impact of their activity on biodiversity, but also commit funds

to conserve and restore it. They also acknowledge that these actions will improve their image to the general public. So in addition to other environment policy instruments to which they are obliged to comply under the law, they are also willing to join these voluntary actions such as: unilateral commitments, public volunteer schemes and negotiated agreements (e.g. business and biodiversity initiative).

At present many of the projects that are in place have been widely publicized and are partnerships between companies and reputable research institutions and NGOs. In these cases there is from the start some guarantee of quality of the projects and commitment from the companies involved.

But as the Portuguese B&B initiative is a voluntary process and does not have any formal regulation or verification mechanism in place, it can be used by some of the companies as a mere marketing operation. So, for this to be a successful initiative, civil society will have to ensure that this scheme works in favour of biodiversity, with verification of the quality and relevance of the projects proposed, and that the companies comply with what they promised when adhering to the B&B initiative; the ICNB will have to actively assure the informal mechanism of the report and the transparency of the process.

Links

1. A Portuguese Magazine on Corporate Sustainability - http://www.impactus.org/
2. BCSD Portugal – http://www.bcsdportugal.org/content/index.php?action=articlesDetailFo&rec=361
3. Biodiversity economics - http://biodiversityeconomics.org/
4. Biodiversity Technical Assistance Units (BTAUs) - www.smeforbiodiversity.eu
5. Message from Lisbon on Business and Biodiversity, 2007. www.countdown2010.net/file_download/143
6. Nature and Biodiversity EU homepage – http://ec.europa.eu/environment/nature/index_en.htm
7. Portuguese Business and Biodiversity initiative – http://portal.icn.pt/ICNPortal/vPT2007/O+ICNB/Iniciativa+Business+and++Biodiversity/?res=1024x768

Annex 1 - Portuguese B&B initiative companies and organisations according with sectors of activities.

Activity		Company / Institution
Agro-industry		- Herdade dos Fartos e Defesa das Cegonhas (*) - Matéria Verde - Viveiro de Plantas, Lda Herdade do Pinheiro, SA - Companhia das Lezírias, SA - Quinta do Valle do Riacho - Herdade Freixo do Meio, Gestão Agrícola, Lda
Airport administration		- ANA - Aeroportos de Portugal, SA (*)
Construction		- Chamartín Imobiliária SGPS, SA
Energy production and distribution	Electricity	- REN - Redes Eléctricas Nacionais, SGPS, SA (*) - EDP - Energias de Portugal SA (*)
	Fuel	- Galp Energia, SA
Engineering industry		- ProCME (*)
Environmental consultancy		- SAIR DA CASCA - Consultoria em Desenvolvimento Sustentável - AmBioDiv - Valor Natural. Ambiente, Natureza e Sustentabilidade, Lda - Bio3 - Estudos e projectos em Biologia e Valorização de Recursos Naturais
Financial sector		- Banco Espírito Santo – BES
Hotel management		- Quinta das Lágrimas Actividades Hoteleiras, SA
Institutional		- CAP - Confederação dos Agricultores de Portugal (*) - ADRAT – Associação de Desenvolvimento da Região do Alto Tâmega (*) - BCSD Portugal
Mining, Extractive Industry		- EDM - Empresa de Desenvolvimento Mineiro, SA - Somincor – Sociedade Mineira de Neves Corvo, SA (*)
Post		- CTT Correios de Portugal (*)
Port administration		- APDL - Administração dos Portos de Douro e Leixões, SA
Product control and certification		- SATIVA - Desenvolvimento Rural, Lda
Production	Cement	- SECIL – Companhia Geral de Cal e Cimento, SA (*)

and Commerce	Cork	- Corticeira Amorim, SGPS, SA (*)
	Wine	- Finagra, SA - Herdade do Esporão (*)
	Cellulose and forest production	- Grupo Portucel Soporcel - ALTRI / Silvicaima Sociedade Silvícola Caima, SA (*)
	Coffee	- Nova Delta - Comércio e Indústria de Cafés, SA (*)
	Beer	- SCC - Sociedade Central de Cervejas, SA (*)
	Beekeeping	- Apilegre - Associação dos Apicultores do Nordeste do Alentejo (*)
	Steel	- Grupo Ferpinta
Rail transport		- REFER - Rede Ferroviária Nacional, EP (*)
Roads construction and maintenance		- Brisa - Auto-estradas de Portugal, SA
Sports events		- João Lagos Sports
Television		- SIC - Sociedade Independente de Comunicação
Tourism		- Sonae Turismo (*)
Water supply and management		- EDIA - Empresa de Desenvolvimento e Infraestruturas do Alqueva - EPAL, SA

(*) Companies who answered the questionnaire

Annex 2 - Examples of the actions already implemented by companies to contribute specifically to the conservation of biodiversity

A) Identification, minimization and monitorization of the impact of their activity in the biodiversity

- Energy company - Multiannual program for the identification of sections of lines that have or can have impacts in birds. As a result 32000 BFD (Bird Flight Diverters) were installed in 78 km of lines.
- Mining, extractive industry - Bio-monitoring program of the Oeiras stream for evaluation of the impacts caused.
- Tourist company - Monitoring program for coastal water quality, energy consumption, coastal dynamic, intertidal environments, wild birds, bats and bottlenose dolphins.

B) Increase awareness about biodiversity

- Cellulose and forest production company - Identification and management of forests of high value of conservation, by adapting the "ProForest" method to the Portuguese reality and of the forest heritage.
- Post - Regular philatelic emissions dedicated to biodiversity subjects and

threatened species, for environmental awareness.

- Agro-industry – Ecotourism and bird-watching.
- Several companies - Environmental education and training actions for employees and other people. Edition of environmental educational materials.

C) Contribution to projects for conservation and restoration of biodiversity and habitats

- Energy company - Conservation of the Bonelli's eagle population in Portugal; Project to improve the action plan of the migrants fishes and habitats conservation state, in a river.
- Airport administration - Reforestation of a burned area with indigenous species, in northern Portugal
- Beekeeping - Reproduction of queens of *Apis mellifera iberiensis*, indigenous subspecies,
- Engineering company - Project for the conservation of the Iberian Wolf and his habitat, in northern Portugal
- Cement Company - Implementation of the environmental plan for landscape recovery.
- Bank - Conservation of the Imperial Eagle, Black Stork and Otter in the International Tagus Natural Park.

D) Promotion of research

- Several companies - Fund for financing awards and direct support to studies and research projects on biodiversity conservation.

RE: The business and biodiversity initiative

Volker Mauerhofer, Vienna University, Faculty Centre for Biodiversity, CVL Department

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This contribution splits up different business cases for biodiversity and argues for the 'problematic ones' to address the surrounding conditions of competition and quantitative economic growth rather than the individual company's business strategy.

I refer to the fundamental issues raised by Martin Sharman who points out the need to address more challenges and critical issues related to the business case for biodiversity. Therefore it might be helpful to distinguish the so-called business case into several situations in order to clarify the issue and to find out the more pressing problems as well as adequate solutions. In general, businesses are most commonly not dealing with biodiversity for its own sake, but in their own interest. With this

background I will distinguish between two situations, which I call 'win-win-situations' and 'problematic situations'.

1. Win-win situations:

- Business activities can directly depend on biodiversity, for example when it comes to the commercial use of medicinal and aromatic plants.
- Business can also indirectly depend on biodiversity when it comes to the direct use of ecosystem services in the sense of the Millennium Ecosystem Assessment, if biodiversity provides a significant contribution to the maintenance of these services (such as described by Mathieu Tolian in the Veolia case earlier in the discussion).

These situations are equipped to achieve a sustainable use of biodiversity if not overused and/or unintended ecologically negative side-effects nullify the gains (in order to simplify the discussion I am not including here negative social side-effects).

2. Trickier to handle are problematic situations:

- Situations where 'eco-efficient' solutions are applied by businesses, e.g. by making one additional product unit or an additional commercial site more energy and/or resource efficient. In all these cases, these gains in energy and/or resources are sooner or later nullified, if an additional number of new product units or sites are constantly produced (the so called 'rebound effect'), driven by the current predominant belief in and concept of unlimited quantitative economic growth.
- Most difficult to address are situations of clear conflict of interests between short-term economic interests of business and long-term interests on sustaining biodiversity.

In the last two 'problematic' cases mentioned, the question 'how can we integrate biodiversity into companies' strategies?' raised in the introduction to session III seems to be too narrow.

Rather we should ask:

- What different surrounding conditions are necessary for businesses which are in a current state of competition, in a sort of prisoner's dilemma, in order to obey the carrying capacity of the public good for biodiversity (see Vineta Goba's contribution) within safe minimum standards on each geographical level (the 'aim')?
- What scientific knowledge (the 'equipment') and what methods (the 'paths')

are additionally necessary in order to achieve these conditions effectively (not only efficiently) and in the quickest manner as well as at the best costs?

- What are the underlying assumptions and probable risks related to the 'aim', 'paths' and 'equipment' and what about possible uncertainties regarding them ('the fog')?

RE: The business and biodiversity initiative

Joël Houdet, Orée – Entreprises, Territoires et Environnement, CREED, AgroParisTech; Paris, France.

I really enjoyed reading Volker Mauerhofer's contribution.
Here are a few complementary comments regarding "problematic situations":

1. The management of "natural resources" is not the same thing as that of renewable resources such as biodiversity, water or the atmosphere (Weber, 2002). Sustaining a mining activity, for example, really amounts to postponing the eventual exhaustion of the mine. For biodiversity, as for any other renewable resource, the problem is: what mode of co-ordination is possible among the users, given the dual requirement of the viability of the resource and the profitability of the operations?

2. There is clearly a need to get beyond the arbitrariness of the debates which rely on an opposition between competitiveness and environmental issues. The impact of environmental policies on businesses' competitiveness depends in part on the specifics of each situation, economic sector or business, from the type of pro-environment efforts initiated to the length of the period of asset engagement. One needs to underline the dependence of cost-benefit analyses on the modes of regulation, incentives and property rights in force. If sources of pollution fall under clearly established property rights, it is socially optimal to make the polluter pay. Similarly, if a premium is put on deforestation combined with the growing of export crops, it is understandable that refraining from exploiting a tropical forest so as to convert it to a monoculture is equivalent to the incurring of an opportunity cost for the business in question.

3. The cost-benefit analyses to take account of biodiversity within business strategies are thus closely related to access, use and property rights. To address the management of resources in terms of land rights can lead to confusion

between ownership of the land itself and of the rights to the resources it contains. A variety of property rights exist, from the traditional (private and public property rights) to the more complex ones (rights of access and use). Biodiversity is far from being a public good! Most of its components are common goods/common-pool resources.

The non-existence of property rights and of access rights leads to the degradation of resources and to economic disaster. As long as profits can be made, more people will show up to exploit the resource. This is what Hardin (1968) incorrectly named the "tragedy of the commons"; in reality it is the "tragedy of free access" (Weber and Revéret, 1993), since common property rights prohibit free access. We need to move on from assessing sustainable exploitation levels and work on understanding the dynamics of the interactions between resources and their users.

Today the globalisation of trade and of production models determines the evolution of biodiversity (Trommetter, 2005). For any elements of biodiversity which possess market value, squandering, excessive exploitation and over-investment will occur if access is not restricted and controlled. Fishing in international waters is a perfect example of this. To ensure the viability of ecosystems and biodiversity, a primary goal is the elimination of situations of free access to resources, regardless of the regime of property rights in place. Businesses have a fundamental role to play to that end, both at the level of the land they own and exploit and that of the ecosystems from which they derive ecosystem services.

4. To that end, we should work on co-viability models of business and biodiversity. A growing number of studies are proposing bio-economic models, especially for fisheries (Béné, et al., 2001; Doyen, et al., 2008; Martinet, et al., 2007), agro-systems (Tichit, et al., 2007) and bodies of water (Martin, 2004). They reveal a profound shift towards a dynamic and viable (Aubin, 1992) approach to ecosystem management. Other studies and models focus on support for economic agents in their interactions, negotiations and choices relative to ecosystems and their component parts: for example, Gurung, et al. (2006) report on conflict resolution with respect to water in the Lingmuteychu watershed in Bhutan. The challenge is to adapt these methods for the interactions between ecosystems and businesses and to support businesses in the necessary transition towards dynamics of co-viability with

biodiversity. Accounting and fiscal instruments will need to be developed (Houdet, 2008 ; Weber, 2007), suited to the viability constraints of businesses, to complement the existing range of tools (Natura 2000, Protected Areas, Environmental impacts assessments, compensatory measures) for promoting the viability of the diversity of living systems.

RE: The business and biodiversity initiative
Industry development and Romania's biodiversity and nature protection sector

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Simona Mihailescu, Institute of Biology Bucharest, Romanian Academy, Romania

Current Situation and Deficiencies:
This paper summarises key strategic information on Romania's biodiversity and nature protection sector and water and waste-water infrastructure sector. We consider the correlation between these sectors very important.

In Romania, a number of projects were prepared technically and institutionally and will be mostly financed by the EU Cohesion Fund, allocated to Romania under Priority Axis 1 and 4 of the Sectoral Operational Programme for Environment for 2007-2013 (hereinafter SOP ENV), which the European Commission (EC) approved. Romania's Ministry of Environment and Sustainable Development (MESD) is the Managing Authority (MA) that has developed and will be implementing the SOP Environment.

The specific objectives of the SOP ENV for biodiversity and nature protection are to:

- Protect and improve the conditions and functions of terrestrial, aquatic and marine eco-systems against anthropogenic degradation, habitat fragmentation and deforestation; and
- Preserve the natural diversity of fauna, flora, and habitats in protected areas and potential Natura 2000 sites.

The SOP ENV is the first large-scale programme for improving management of protected areas, particularly those in the Natura 2000 network. For the implementation of the EU directives related to biodiversity and nature conservation: Habitats (92/43/EEC) and Birds (79/409/EEC), Romania's Natura 2000 network has defined 108 Special Protection Areas (SPAs) and 273 proposed Sites of Community Interest (pSCIs). The pSCIs will be finalised at the end of the Bio-geographical seminars for all five bio-geographical regions which cover Romania (end of 2009). After the first

seminar in 2008, experts will conduct the research necessary to supplement the list of sites of community importance and develop a data base according to the EC requirements. In response to the EC's request, the distribution of species and/or habitats at the national level may change. As a result, the projects approved under the SOP ENV could be amended.
In 2007, the MA launched the first call for proposals under Priority Axis 4-biodiversity and nature protection sector and received 48 applications. The first funding decisions for 15 projects are expected to be signed in October 2008; most beneficiaries are administrators of protected areas subordinated to the National Forest Authority.

EUROSTAT data confirm the poor status of water and waste-water infrastructure in Romania (compared to other EU countries) and highlight the need for urgent investments in this sector; about 70 percent of households in rural areas use wells for water supply and about 230 small and medium-sized towns have not been able to attract financing from either international financial institutions or private operators in terms of the necessary investments for 2007–2013.

Without grants, most of the smaller operators could not comply with the Acquis. Accordingly, there is a strong incentive for the different operators to join the ROCs. This is particularly important, given the central role of the Regional Operating Companies (ROC) in SOP implementation. The number of ROCs is expected to increase from 10 to 35. For localities that cannot be included in a regional project, in well justified cases, the SOP can support individual or smaller projects, provided they comply with all relevant requirements, particularly a viable operator in place to ensure proper maintenance of future facilities to be built with EU funds.
Rules for project preparation and evaluation: gives essential information to fill in the financial application and the evaluation criteria of the project, with details on: Master Plan, Feasibility Study, Economic and Financial Analysis, Institutional Analysis, and Environmental Impact Assessment.

National Objectives and County Targets: Summarises the relevant national water and waste-water policies, objectives, and strategies are defined in the Accession Treaty and SOP ENV, based on the relevant EU Directives.

Long-term Investment Plan: Identifies the need for investments in water and waste-water services to fully comply with relevant EU Directives, and identifies the requirements for Technical Assistance to ensure adequate management capacity of the

beneficiary.

Habitat fragmentation: Generally, the springs, rivulets and rivers in woodland areas are less studied and they are strongly affected by the forest cutting. Intensification of investments as part of the country's industry development without any measures for mitigation of the impacts on biodiversity, species and habitats (due to development of energy and communication infrastructure, business and production development, etc.) will lead to further habitat fragmentation and biodiversity loss.

Water quality: Water quality improvement in the different water basins was observed during the recent years in Romania due to the reduction of animal farms and closure of different polluting industries during the last 17 years.

Ground water: An overall assessment of river basins shows a critical situation of the quality of aquifer from many areas of the country. These will affect both the water quality and life form. More attention should be for analysis of risks of water exploitation in the mountain Karsts areas. This water sources is used for supplying new buildings and resorts. It can have possible negative effects on subterraneous water regime/on cave fauna.

Ecological evaluation for restoring the initial environment in cases of areas with major anthropogenic intervention should be done based on the analysis of the systems phases, as initial damage by human interaction and restored as close as possible to the initial status.

As a direct consequence of constructing dams and dykes, it is observed that there is a decrease of reophilous species and an increase in the number of species in stagnant water. Biotic diversity of running water highly depends on aquatic systems of flooded plains. More attention should be on the study of changes that occur in these fragments of running water. The question is: What happens in the running water between two dam reservoirs?
The poor water quality is caused mostly by anthropogenic point and diffuse source pollution. The insufficiently treated water discharges contain mainly organic substances, suspended solids, phosphorus and ammonia.

At present, the National Strategy and Action Plan for the Biological Diversity and sustainable use of its components in Romania does not include a special request for "biodiversity and industry".

It is in the implementation phase (2008-2009) of the UNDP-GEF project "Support to alignment of NBSAP with CBD obligations and development of CHM". The overall objective of this project is to enhance the national capacity to implement the Convention on Biological Diversity (CBD) and decisions of the Conference of the Parties (CoP), provision, through addressing institutional and human capacity gaps, and adopting a more integrated approach to biodiversity conservation. The main project deliverables are the Romanian Biodiversity Strategy and Action Plan and a Training Framework document, for capacity building in CBD priority areas of implementation.

We hope this project will include a special chapter for "biodiversity and industry" and also an adequate action plan adapted to Romanian conditions.
The general objectives for the biodiversity research development are:

1. Understand how conservation of biodiversity and restoration schemes can contribute to the mitigation of climate change.
2. Understand the influence of extreme weather events, flood, drought, fire and other catastrophic events in southern and south-eastern European countries on biodiversity, conservation and sustainable use in the context of a changing climate and other long term drivers.
3. Understanding the contribution of biodiversity to ecosystem services.
4. Understand and evaluate the contribution of natural capital and ecosystem services to sustainable economies.
5. Improve methodologies and tools for ecosystem assessment and adaptive management including: indicators for ecosystem functions and services; methods to deal with uncertainties, irreversibility, complex dynamics and non-linear changes; decision support systems and scenarios for future trends.
6. Identify new measures, and modifications to existing land and water use systems, including the potential contributions of rural businesses, to protect biodiversity in extensive systems and High Nature Value Farmland areas from negative impacts of land abandonment or land use intensification.

RE: The business and biodiversity initiative
Business and biodiversity in the Ukraine: feeble attempts to engage.

Viktor Gasso, Department of Zoology and Ecology, Dnipropetrovs'k National University, Ukraine

The permanent state of "transition economy" tenaciously holds the Ukraine at the initial point of positive interaction of business and biodiversity. As a result, Ukraine has 10 tons of wastes per 1 sq.km, water use per a product unit by 4.2 times more than in Great Britain and Sweden, 130,000 hectares are occupied by disposal tips, and 18 % of the territory is stricken by erosion (http://www.greenparty.ua/news/greenparty/green-party_17371.html).

Positive cases are presented by:

1. Series of legislative enactments,
2. Working out special conceptions on environmental protection in most Ukrainian regions,
3. Separate examples of real biodiversity rehabilitations made by industrial enterprises.

1. The legislation of Ukraine includes: the Law "On protection of the environment", the Law "On environmental expertise", the Law "On ecological audit", the Law "On formation of a national ecological network", the Supreme Council's Decree "Basic lines of state policy of Ukraine in the area of nature protection, natural resource use and ecological safety", Water Code, Land Code and Forest Code of Ukraine, etc. All of them address the problem of nature and biodiversity protection to a greater or lesser extent.

   But, the daily problem is a declarative nature of the decrees. The mechanisms of realization of most dispositions are undeveloped. As a result, the legislative violation is not necessarily the case for a chastisement.

2. The legislation, development of nature protection oriented NGOs, demands of the international communities, especially the EU, give rise to the working out of regional Conceptions of environmental protection. The purpose of the Conception is the working out and realization of measures on the environment improving biodiversity conservation, sustainable use and rehabilitation of natural resources. It means that regional budgets should assign means for biodiversity protection, including the introduction of the issue in the industry and agriculture development. But, decisions on the protection of biodiversity are required for all new, anticipated industrial projects and poorly infringe on operating enterprises' interests. Under conditions of political and economical instability

providing measures and funds for biodiversity conservation and rehabilitation remain only on paper. The nonfeasance of liabilities in the area of "biodiversity" becomes usual.

3. Despite the general dismal picture there are some promising examples. "Ordzhonikidze Ore Mining and Processing Enterprise", which is exploring manganese ore by the open-cut method, has put into practice the complex of directional measures of landscape and biodiversity rehabilitation. Firstly in Ukraine this successful activity allows the establishment of the state reserve of 121.1 ha. Stringent forbidden regimes stimulate migration of many species from adjacent territories. Species introduction adds many functionally important ecosystem components (plants and animals). As a result, sustainable development of the rehabilitated territory is maintained.

But, and here we are concerned with issues put forward by Nicolas Bertrand, Martin Sharman, Vladimir Vershinin and Joel Houdet, Ukraine faces the same problems, but at a more environmentally dangerous level. The financial and economic crisis in Ukraine means that all efforts will be turned to earning money and, under conditions of undeveloped "biodiversity" legislation, at any price. So, to "find ways to make a business case out of protecting, conserving, and cherishing the diversity of life" (Martin Sharman) will be generally alien to Ukrainian businesses. All positive examples in Ukraine are presented by several large companies as well. Small and medium enterprises are beyond the process. In the present state of affairs the key possibility to improve the situation is putting the Ukrainian legislation under the EU norms. Aspiration of Ukraine for joining the EU may be one of the causes to improve interaction of biodiversity and business in the country. That is why the EU strategy is very important for Ukraine, which is not a member country.
However, as each good deed originates from education, the biodiversity oriented culture remains the urgent problem for the general community in Ukraine.

Biodiversity valuation: the next step to help companies integrate biodiversity into decision-making processes

This contribution highlights the use of valuing biodiversity in order to enable companies to assess the benefits for them in investing in biodiversity.

Claire Tutenuit, Entreprises pour l'Environnement (EpE), France

Integration of biodiversity in company strategies depends on the expected benefits. Benefits may be an improved quality of life on industrial sites, a higher motivation of workers, possible increases in productivity, improvement in resource conservation, image and reputation, etc. However the reality of this is that such benefits are difficult to measure, at least in the short term.

Valuing biodiversity could help companies to assess a return on their investment in biodiversity. Using a common indicator such as the Euro gives clearer information and helps in defining priorities. But this is not an easy task, a lot of work has already been done, but research in this area still has to be fostered, especially for:

- Multidisciplinary research because the involvement of all - scientists, economists, ecologists, politicians, etc. – will be required for a concerted and efficient method of valuation to emerge,
- Economic research which could result in the launch of a biodiversity market,
- The purpose of aggregating different types and uses of biodiversity and ecosystems.

In this case, the scope of biodiversity valuation has to be closely observed. Existing studies mainly focus on the value of ecosystem services and restoration costs. Attempts to take into account non use value of biodiversity have to be strengthened: patrimonial value of nature could/ should be a key part of the total economic value calculation. It is also important to point out that not only protected species but also "ordinary" biodiversity has to be valued for its contribution to the efficiency of global ecosystems. Valuation of rare and endangered species and their environmental condition should be made using "wild values" to efficiently represent their scarcity value.

RE: Biodiversity valuation: the next step to help companies integrate biodiversity into decision-making processes

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Dominique Proy, Earth Interactive Governance Ltd, Paris, France

Claire Tutenuit's statement is particularly relevant. Eurostat tries to measure biodiversity by defining some quantitative indicators as the follow link shows:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1998,66119021,1998_66391726&_dad=portal&_schema=PORTAL

However, how this attempt could be precise enough to apply to enterprises, not to SMEs, is very difficult to imagine.

Biodiversity integration in farming systems

Edouard Forestié, SAF-agriculteurs de France (foresight think tank for agriculture and rural development), Paris, France

Biodiversity considerations are an integral part of farming activities. Some actions are done to preserve biodiversity and others are done to offset impacts on nature. Farmers need indicators to evaluate their actions on biodiversity.

To maintain productivity levels, farmers need to preserve nature (crops, livestock) which represent their production factors. Sustainable agriculture is the key to maintaining crops/livestock in optimal conditions, long-term.

Some agricultural practices are done to preserve biodiversity and to limit impacts on agricultural ecosystems:

- Pesticide use in fields is limited, by providing only the necessary dose to crops.
- Synergies between crops and animal breeding help to minimize artificial fertilizer inputs in fields. Wastes from animal breeding can easily provide the organic matter and fertilizers needed for cultivation.
- Agricultural activities generate diversified landscapes, provide tourism opportunities and maintain economic activity within rural areas, especially in mountain landscapes which can suffer from a lack of attractiveness and competitiveness.
- Farming helps prevent the risks associated with neglected landscapes, which can lead to biodiversity loss (bush encroachment, forest fires).

Agricultural activities can disrupt biological diversity. Consequently, farmers act to provide biodiversity offsets. Here are some examples:

- Hedges are planted (trees, shrubs) along fields, which are used by various species. They can create smaller plots from a large field, contributing to the spatial heterogeneity necessary for biodiversity.
- Contracts with beekeepers to protect biodiversity by sowing seed assortments on set-aside land.

SAF-agriculteurs de France helps farmers to develop an integrated approach reconciling farming activities with biodiversity. But they need easy-to-use indicators to estimate their impacts on biodiversity. Many tools exist but they are either too

specific or too research-orientated. A biodiversity indicator would be widely used if it was practical to use by farmers. That means a universal quantitative method, which quickly provides results to the farmer. Thereafter, it would be easier for farmers and farming advisers to implement improvements.

An ecologist's message at the heart of our corporate strategy

Daniel Baumgarten, Séché Environnement, France

Séché Environnement is a company that is active in waste treatment, and is therefore in a profession that is totally dedicated to the environment. For this reason, the preservation of biodiversity has been an integral part of its corporate culture and strategy since its creation.

The specificity of Séché Environnement's activities, especially waste storage, means that as soon as an operating permit has been awarded at a particular site, a study of the impact on fauna and flora is carried out, as well as a study for the integration of the site in the landscape. Based on the results of these studies and on the company's desire to preserve the local natural heritage, we include in a master landscape plan the natural areas to be protected and the guidelines for restoration programmes right from the design stage of our sites.

These areas are part of geographical sectors where vulnerable species have been recorded, or where there are notable landscape features.

Over and above the special protection status that is give to these sites, these sectors are subject to programmes that monitor the different species or fauna groups concerned, especially avifauna and amphibians, which are bio-indicators for air and runoff water quality (Avifauna monitoring programmes).

These monitoring campaigns are carried out by naturalists who are part of our operating teams, especially for monitoring amphibians. Concerning avifauna, the monitoring protocol is that of the National Museum of Natural History (Paris): the STOC-EPS (Programme for the Temporal Monitoring of Common Birds) is carried out by local naturalist associations or by members of the 'Ligue de Protection des Oiseaux' (BIRDLIFE: International).

I can sum up our approach in a few points. Séché Environnement:

- Preserve heritage value sectors from the design stage of the project
- Implement measures for monitoring the maintenance of biodiversity
- Do not separate landscape and biodiversity, i.e. we include in landscaping and restoration programmes the items necessary to enhance biodiversity, paying special attention to the selection of plants, shrubs, trees and seeds.

- Set up appropriate management of natural sectors, especially by using what we call ‘differentiated management’: a tool that determines the methods and timings required for maintaining protected natural areas and nearby areas.

Anticipation and long-term commitment are the keys to maintaining a positive and sustainable impact on a natural environment. The work that Séché Environnement has been doing for more than 15 years today enables us to measure the real effectiveness of our choices concerning the recognition of our commitment to biodiversity in our corporate strategy.

Engaging business in biodiversity conservation

Rik Kutsch Lojenga, Union for Ethical BioTrade, Switzerland

Consumer awareness on biodiversity needs to be raised to promote business engagement. Ethical BioTrade may be a useful model to promote integration of biodiversity in business models and production chains. An interesting trend can be seen in the personal care and cosmetics industry where biodiversity starts to become a factor of growing importance.

Biodiversity: do we really care?

The signatory parties to the CBD have come to realize that business needs to be involved in the sustainable use and conservation of biodiversity if the Convention is to reach its objectives. Special decisions on the private sector (VII/17 and IX/26) therefore call upon parties to engage with the private sector.

However, in times of global financial crisis and attention to climate change, biodiversity may unfortunately be pushed aside. During the IUCN World Conservation Congress that was recently held in Barcelona, it was announced that the financial losses related to natural losses are much bigger than the evaporating billions on the financial markets right now. Yet, this information has not made the headlines and has certainly not resulted in emergency injections of billions of dollars to halt the loss of biodiversity.

This clearly illustrates one of the main challenges that we face when promoting integration of biodiversity into business strategies. Biodiversity is not seen as priority number one, and consumer awareness or even understanding of the very concept of biodiversity is still limited. Biodiversity simply does not sell as well as the images of islands disappearing because of rising sea levels, or the loss of individual iconic species like polar bears because of melting ice caps.

Raising consumer awareness on biodiversity and on the impact that business can have on biodiversity, both positive and negative, would be an important step forward to engage the private sector.

Integrating biodiversity in business models?

There are various ways in which biodiversity can be integrated in business strategies. During session I of this E-conference, the issue of biodiversity offsets and payments

for ecosystem services was already discussed as a way of compensating the biodiversity impacts of business. Another important avenue is enticing businesses to integrate good biodiversity practices into their very business models. This is particularly relevant for those business sectors that are directly based on biodiversity. Joel Houdet already asked if it would be possible to make biodiversity a management/production standard, so that business activity would actively promote diversity instead of the current homogenization promoted by crop selection processes and the subsequent single crop agricultural systems.

An approach that the BioTrade Initiative (bio standing for biodiversity) of the United Nations Conference on Trade and Development (UNCTAD) has championed is that of encouraging businesses to use native species (instead of introduced or alien species). Native species are often well adapted to their local ecosystems and climates, and often require less external inputs. Use of native species contributes to the valuation of local biodiversity and associated local knowledge, and often increases the resilience of such ecosystems to more extreme weather conditions that are likely to come with climate change.

Introduced in 1996, the BioTrade concept is slowly gaining recognition. The work of the UNCTAD BioTrade Initiave has now been recognized by various decisions of the CBD, including the ones on business. A number of governments of developing country have included the concept in their national biodiversity strategies and national development plans.

In 2007, a group of companies and non-private actors from all over the world created the Union for Ethical BioTrade, a non-profit association based in Geneva. Companies that are members aspire to source species from the areas to which they are native, and commit to implementing a standard developed by the Union for Ethical BioTrade. The standard's core principles are taken from the BioTrade Principle and Criteria defined by UNCTAD and are modelled on the three main objectives of the CBD: conservation, sustainable use, and benefit sharing. Recognizing the importance of a sectoral approach, the Union for Ethical BioTrade has started off in the personal care and cosmetics industry, although other areas may follow suit.

Businesses from both developed and developing countries and from all stages of the supply chain are members of the Union for Ethical BioTrade and commit to the same principles and criteria. This illustrates the production chain perspective that Stefan van Esch advocated in session I. Businesses at the end of the production chain will

need to have a management system in place to take into account CBD provisions in their R&D activities and/or biodiversity considerations in their purchasing decisions. Businesses/producers at the beginning of the production chain will need to have good biodiversity sourcing practices in place. Realizing that putting such systems in place throughout entire production chains takes time; members of the Union for Ethical BioTrade have 5 years to complete the process. A number of companies have recently embarked on this journey and over the next few years many experiences and best-practices will certainly come to light.

Integrating biodiversity in personal care and the cosmetics industry:
Those that watch the personal care and cosmetics industry will have noted an interesting trend with regard to biodiversity. Driven by consumer interest in novel, natural, organic and fair trade products, and cautious because of public scrutiny of cases of possible misappropriation of traditional knowledge or genetic resources, companies are actively turning towards ethical sourcing practices. Market leaders like L'Oreal are making explicit reference to biodiversity and the CBD in their sustainable development reports explaining which strategies they are following to make their sourcing more sustainable . Interest is growing in voluntary approaches and standards and in industry best-practices. With this, questions regarding biodiversity and the CBD are arising, and a need for guidance on biodiversity related issues is becoming apparent.

Trend watchers predict that biodiversity will become more important in this sector in the future. To illustrate the point, during Beyond Beauty, an industry trade show in Paris in mid October, Aïny, a newly established brand received the 'top-pick award' for a range of skin care products produced from active extracts sourced in the rainforests of Peru and Ecuador .

With relatively small volumes, luxury goods, and strong brand names, the cosmetics industry may not be fully representative for other sectors. However, the lessons learned will certainly be of great use.

RE: Engaging business in biodiversity conservation

Joël Houdet, Orée – Entreprises, Territoires et Environnement, CREED, AgroParisTech; Paris, France.

Addressing biodiversity issues throughout the supply chain is a major challenge

indeed, and a vital one as well. We look forward to seeing the results of the important work being done by the Union for Ethical BioTrade.

Is the process leading to the development of an accounting system, with information to be made publicly available for CSR purposes? Or more towards labelling tools? Or inter-firm information systems for trading purposes?

RE: Engaging business in biodiversity conservation

Rik Kutsch Lojenga, Union for Ethical BioTrade, Switzerland

In response to my brief introduction to the Union for Ethical BioTrade, Joël Houdet asked some pertinent questions:

1. Is the process leading to the development of an accounting system, with information, to be made publicly available for CSR purposes?
2. Or more towards labelling tools?
3. Or inter-firm information systems for trading purposes?

These questions are not easily answered as the Union for Ethical BioTrade combines elements of all three systems.

The Union for Ethical BioTrade has adopted an approach that combines a system-based approach (such as ISO 14000) with a product conformity approach (used for example by product labelling schemes). This means that our member companies develop a management system, which pledges that they will consider biodiversity in their sourcing activities. The Union's internal verification framework functions as a benchmark in this process. This system approach allows companies to set up and implement their management system according to their own priorities and methodologies, respecting for example their investment cycles. Member companies will conduct annual self-assessments and report on the progress in their work-plans; the reports will be available to the public. At the same time, member companies also need to make sure that their systems bring about the desired biodiversity practices throughout the supply chain. This is where the product compliance approach comes in. For instance, have the products bought by our member companies actually been produced with respect for biodiversity related issues?

External auditors verify the members' management systems every 3-5 years, which includes random checks of specific supply chains. Companies will be able to market

their membership to the Union for Ethical BioTrade, but there will be no labels on their products that make claims regarding biodiversity aspects. Therefore, it is expected that the main emphasis will be on business-to-business communication and marketing, or as Joël Houdet names it, inter-firm information sharing for trading purposes.

Biodiversity and Industry: Organizational competencies as a measure of adaptation

Eeva Primmer, Finnish Environment Institute, Helsinki, Finland

Conservation of biodiversity is dependent on the creation of capable organizations to integrate conservation and utilisation of natural resources. Organizations that manage natural resources develop and apply biodiversity conservation competencies to respond to evolving social demand and to maintain legitimacy and competitiveness. The ways in which they invest in resources to develop these skills allow us to better understand their adaptation strategies and the contexts in which adaptation occurs.

We study stocks and flows of biodiversity conservation competencies within public, private and professional organizations that make up the Finnish forestry sector. Specifically, we analyze human capital, management systems and networks (i.e., linkages to external resources). Our pilot work provides a starting point for conservation competency accounting, and our analysis of data from a nationwide survey of forest planners responsible for biodiversity conservation is currently under review for publication.

Our conceptual framework and empirical approach may be useful tools for assessing and supporting biodiversity conservation at the level of organizations, sectors and territories. Accounting of competencies and resources that organizations rely on to integrate biodiversity conservation into extractive functions (e.g., farming, forestry, fisheries, mining...) will provide rich opportunities to trace change and draw comparisons within and across sectors.

Management of biodiversity and food consumption

Yann Maubras, Foundation for Research on Biodiversity (FRB), France
Hélène Leriche, Foundation Nicolas Hulot (FNH), France

How should the link between the everyday life of citizens and biodiversity be re-established? By taking into account the impact of food consumption on biodiversity. This contribution outlines the idea of using an informative labelling system of food products to give impact of consumption on biodiversity: eco-labelling with a "biodiversity foot-print".

1. Sound concept: "A challenge: preserving biodiversity"

Biodiversity, and its current erosion, is one of the sustainable development issues, which are often forgotten. Besides the lack of interest that most of the political decision-makers pay to this issue, another possible reason for this is the low level when it comes to public awareness of biodiversity and its implications. The assumption of this project is that the political inability to prevent biodiversity loss results from a weak public understanding and ownership of this issue. Scientific topicality, both biological and human, shows the necessity for public awareness as an essential precondition for efficient action. Citizens are thus responsible and involved in the answers that should be provided. Moreover, the conclusions of the Millennium Ecosystem Assessment (2006) followed by those in the Stern report (2007), and the ones temporarily published in the TEEB report (in editing process) show the urgency to act and hence the necessity for citizens to feel concerned by current ecological changes. Nevertheless, despite the many alerts given and the various measures to raise awareness implemented at all levels (children, adults, schools, media…) the question of biodiversity loss still seems to be a minor concern for citizens who so far have not assimilated the idea that their everyday life is closely linked to this major issue.

Whereas ecosystem health, and indeed ecosystems are concepts that most people have difficulties understanding, biodiversity represents the component of renewable natural capital that people everywhere can relate to, or understand. Biodiversity is neither a marketable good or product, nor a service; it is the living web that connects the tangible and intangible elements of healthy ecosystems, which is the essence of so-called renewable natural capital. The maintenance of biodiversity is therefore not just an ecosystem service among many: it is the 'sine qua non' of ensuring a sustainable future.

That is why the maintenance of biodiversity requires a greater awareness on the part of all people of the dependence of our societies on biodiversity and on healthy and resilient ecosystems and landscapes, and it also requires an understanding of the fact that we are now in a state of ecological overshoot –i.e., that we consume more each year – approximately 1.3 times more than the Earth can replenish (Wackernagel et al., 2002). What many people in Europe and other highly industrialized areas do not realize is where the energy, food and ecosystem services we consume come from (Raven, 2002).

Despite the many warnings and consciousness-raising initiatives, the issue of the loss of biodiversity still remains very far from most citizens' concerns. Biodiversity and its future have to be linked to people's daily decisions and behaviour.

2. Overall objective:

To address Europeans' awareness and appreciation of biodiversity in their everyday lives and in their search for well-being, the project will focus specifically on food, both one of the basic functions of human everyday life and one of the main ecosystem services. As an output of the research, the "Tool" will help to establish the impact that everyday activities and choices about food have on biodiversity.

So the project could try to recreate the interdependence between citizens and territory through the theme of "The plate". Indeed, everyday, citizens can be questioned on their link with the living (domestic and wild) as a food consumer.

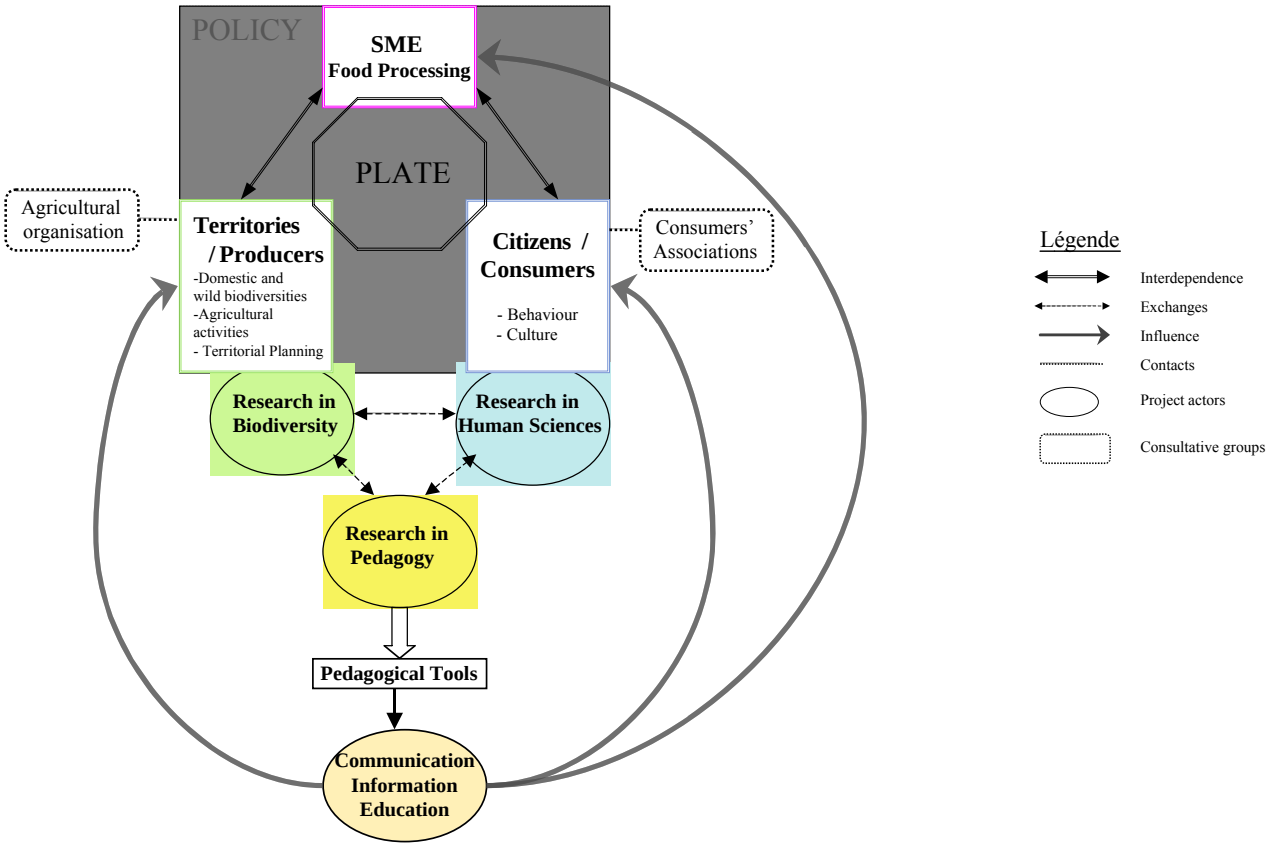
In order to reach this objective, the project must implement interdisciplinary research to "develop tools to raise citizen's awareness to biodiversity" and thus to increase citizen demand and wait for real political commitments in terms of research and action in favour of biodiversity. Specialists of Life Sciences, Socio-economic and Human Sciences and Educational Sciences will have to collaborate and work together in the project.

3. Approach and S/T methodology:

- To create connections between food chain activities and biodiversity indicators: elaborate new indicators and/or adapt already existing indicators permitting to measure the impacts of food consumption of several food chain activities on the evolution and management of biodiversity
- To identify the ways in which citizens make their decisions regarding food

- To identify citizens' perception of biodiversity as well as efficient educational methods to communicate with them on issues related to biodiversity
- To disseminate the output of the project ("Tool") and adapt it to each stakeholder, thereby contributing to the framing of the public debate on biodiversity
- To implement a modelling approach which will get the methodology to construct a prototypic model to calculate the "Tool" of a food processing chain and the scenarios
- To value these results by converting them into an informative labelling of proposed consumer goods giving the measure of their 'biodiversity footprint' and its declination into labels

The general approach can be summarized in the schema below:



TEEB – The Economics of Ecosystems and Biodiversity: Invitation to contributions for Phase 2

Carsten Neßhöver (Helmholtz-Centre for Environmental Research – UFZ, Leipzig), **TEEB Scientific Coordination Team**, on behalf of Pavan Sukhdev, TEEB Study Leader and the TEEB team

The Interim Report of the TEEB-Initiative, published in May 2008 at CBD COP9 raised the attention on the urgency of improving economic measures to safeguard biodiversity and ensure its sustainable use. But it also showed that many gaps in our knowledge remain. Phase 2 of the TEEB will address these gaps and the TEEB team invites all interested experts to provide their input into the process.

Phase I of TEEB was launched by the G8+5 in Potsdam, Germany, in March 2007. An interim report, presented at the 9th Conference of the Parties of the Conventions on Biological Diversity, provided strong evidence for significant global and local economic losses and human welfare impacts attributable to the ongoing losses of biodiversity and degradation of ecosystems. Phase I outreach highlighted and broadcast some important issues which had not hitherto occupied 'centre-stage', such as the correlation between biodiversity/ ecosystem losses and the persistence of poverty, as well as the importance of openly recognizing the role of ethics in our treatment of risks and uncertainty and in how we use social discount rates to assess future costs and benefits. Finally, the Interim Report of TEEB highlighted many different examples of efforts to build these economics into policies and achieve 'win-win' solutions for biodiversity conservation as well as economic growth.

For details, see the TEEB Interim Report at:
http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/teeb_report.pdf

Phase II of TEEB takes this initiative forward with the overarching aim of mainstreaming the economics of ecosystems and biodiversity. To do so, Phase 2 envisages a complex suite of deliverables:

- Develop further the TEEB valuation framework – building further on the Phase I report by investigating the state of knowledge on ecosystem dynamics, exploring how to reflect thresholds, identifying alternative indicators alongside measures of economic value.
- Recommend valuation methodology – after evaluating alternative approaches and socio-economic contexts, examine further some values not addressed in

depth during Phase I (e.g. resilience values of biodiversity, option values such as bio-prospecting, non-use values such as bequest & existence values) and some biomes (oceans, poles) not examined in detail in Phase I, as well as biodiversity benefits such as health and pollution control in urban and agricultural areas.

- Based on the above, an evaluation of policy costs – the costs and opportunity costs of conservation policies versus the costs of 'business-as-usual' within an existing policy framework (e.g. agriculture, fisheries, infrastructure, climate change, etc) that cause ongoing losses of ecosystems and biodiversity.

Based on these scientific issues, which are envisaged to be published in a report in late 2009, TEEB will further develop 4 end-user related reports:
These are, as you will see, directly related to the topics of our ongoing e-conference:

1. TEEB for policy-makers – both national and international, covering aspects such as subsidies and incentives, environmental liability, market creation, national income accounting standards, reporting requirements, eco-labelling, etc. (see contributions from session I)
2. TEEB for local administrators – covering location-specific, cost-benefit analysis and cost-effectiveness analysis, and their use in methods and guidelines for implementing payments for ecosystem services, as well as equitable access and benefit-sharing arrangements for genetic resources and protected areas. (see contributions from session I)
3. TEEB for private enterprises – how to quantify, disclose, mitigate or offset business impacts on ecosystems and biodiversity, as well as their carbon footprint. (see for example the discussion on the contribution by Nicolas Bertrand)
4. TEEB for consumers – how to reduce their impacts on wild nature while influencing producers through private purchasing decisions. This will include steps to improve consumer information on the land, water and energy resources used in producing foods and consumer goods. (see for example the contribution by Yann Maubras and Hélène Leriche)

For all these 5 Deliverables- the scientific and the 4 end-user reports – a broad involvement of scientific and other experts is highly appreciated. The TEEB team will use the input into this e-conference and also invites all participants to contribute directly to the TEEB process.

If you are interested, take a look at the general TEEB website for updates:
http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm
and especially take a look at the Call for Evidence website. Here you will find the current outlines for the different TEEB Deliverables and will be able to comment, or send material relevant for them to the TEEB team:
http://ec.europa.eu/environment/nature/call_evidence.htm
Currently, the Call is open for Deliverable "D1 – The TEEB for Policy Makers Report". The Call for other Deliverables, especially "D0- The Scientific Basis", will open this week.

RE: TEEB – The Economics of Ecosystems and Biodiversity: Invitation to contributions for Phase 2

Dave Stanley, E3 Sustainability, UK

Carsten Nesshover and the TEEB team stated:
"Finally, the Interim Report of TEEB highlighted many different examples of efforts to build these economics into policies and achieve win-win solutions for biodiversity conservation as well as economic growth."

This epitomizes the problem of 'environmental economics'. Economic growth is defined by GDP in its various measures. In reality GDP has little to do with wealth creation, expansion of man-made capital or even wellbeing, etc. In reality GDP correlates extremely well with energy consumption, resource depletion (including natural capital) and waste generation (before recycling). How one delivers a win-win solution for biodiversity conservation with the requirements to deplete it to deliver economic growth (GDP) is indeed a challenge.

I would suggest that the magic wand to tackling this conundrum involves understanding the role of discount rates. I quote from the HM Treasury Green Book:
"Society ... prefers to receive goods and services sooner rather than later, and to defer costs to future generations ... 'the social time preference rate' (STPR) is the rate at which society values the present compared to the future" (UK uses + 3.5%).
Until such times as a negative discount rate is universally applied the conundrum of sustainability and economic growth as measured by GDP will not be resolved.

This does not necessarily require a conscious political decision.

Integrating biodiversity into SMEs

Vineta Goba, ECNC (European Centre for Nature Conservation), Latvia

SMEs are an integral part of Europe's economy and it is therefore vital that they play their part in making the European economy more sustainable. There are 23 million SMEs in Europe, and such companies represent about 99% of all businesses and nearly 60% of the total economy value. According to the European Commission (2003), within the group of SMEs, the vast majority (over 90 %) are micro enterprises, employing fewer than 10 people.

In EU countries, the major public policy tools for the protection of biodiversity are in place (the Habitats and Birds Directives and the Natura 2000 network), but little has been done to enable SMEs to adapt to these.

Biodiversity is a public good, but the question is how to combine the public good aspect with commercial investment, capturing the interest of the private sector. In principle, this is no different to the regulation and financing of the protection of other public goods such as air and water, but currently systems are not yet in place for biodiversity.

The current status in most EU countries is that in spite of political commitments, so far there is lack of commitment from the state to act as co-financier to promote biodiversity oriented SMEs. The state programmes and policies, including grant aid, are focused on general policy issues rather than on business needs, even if business is expected to deliver the policy goals. This is a widely recognized constraint for development of pro-biodiversity oriented enterprises. Besides, SMEs, and especially micro-enterprises, are considered a market segment of high risk and low liquidity, and consequently in many cases they experience restricted access to finance.

Several new mechanisms are currently underway to facilitate the creation of a biodiversity investment market in Europe and sharing of expertise, such as EU funded Biodiversity Technical Assistance Units Project (for further details see project website: www.smeforbiodiversity.eu)

The current challenges are continued support in the form of technical assistance for project identification and preparation, setting up specific biodiversity oriented funding facilities, verification of biodiversity benefits of investment projects, information

sharing and capacity building at all levels.

RE: Integrating biodiversity into SMEs

Martin Sharman, European Commission, Brussels, Belgium

Vineta Goba said, "In principle, there is no difference to the regulation and financing of the protection of other public goods such as air and water, but currently systems are not yet in place for biodiversity."

I think this is too quickly said. Too quickly said, and I, for one, don't think that it is true. Nobody claims to own the air in their factory or house. Few would believe they own the water in the weedy ditch marking the end of their garden. The air and the water flow in and out, there are relationships to be maintained with neighbours and in the case of water, with those up- and down-stream.

Biodiversity isn't like that. If I want to tear up the plants in my garden and convert it into a barbecue pit, that is nobody's business but mine. In some municipalities I could be constrained by local zoning and construction laws, but I doubt that any local authority would go so far as to stipulate which plant varieties might be replaced by which other plants in my herbaceous border, or in my commercial greenhouse. If I want to overgraze my land, and alter the ecosystem from a fertile meadow to a field full of thorny, toxic weeds, who will complain? How can you put into place legislation that determines what kind of pollen may leave my forest? How would that legislation deal with hybrids, mutation, or evolution? Or even something as simple and depassé as set-aside?

N.B. The views expressed are purely those of the writer and may not in any circumstances be regarded as stating an official position of the European Commission.

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