

# Biodiversity research that matters!

Report of an electronic conference, November 2004



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## Preface

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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 BioPlatform network. BioPlatform is a network of scientists and policy makers that work in different fields of biodiversity and aims at improving the effectiveness and relevance of European biodiversity research, fulfilling functions that provide significant components of a European Research Area. BioPlatform supports the existing “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, exchange of information on national biodiversity activities and the dissemination of current best practices and information regarding the scientific understanding of biodiversity conservation.

This is a report of the BioPlatform E-conference entitled “Biodiversity Research that matters!” preceding the EPBRS meeting to be held under the Dutch Presidency of the European Union in Amsterdam, the Netherlands from the 10<sup>th</sup> to the 13<sup>th</sup> December 2004.



## Summary

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The Message from Malahide and the Killarney Recommendations set ambitious goals for biodiversity research in support of the 2010 targets. How are these goals to be reached? How can the scientific content of the Killarney Recommendations be translated into policy and implemented?

While there are many examples of constructive and effective co-operation between biodiversity research and biodiversity policy-making, the link between research and policy is not always effective. The aim of this BioPlatform e-conference and the Amsterdam EPBRS meeting is to explore research-policy interaction in the field of biodiversity, to help to reach the 2010 targets. The e-conference and meeting will draw conclusions about the factors that influence the success of research-policy interaction in biodiversity, and identify ways to stimulate interaction between researchers, policy makers and the public. One of the products of the Amsterdam EPBRS meeting will be an inventory of realistic actions that can be undertaken to improve interaction between biodiversity science and biodiversity policy.

Concrete opportunities for action to improve the research-policy interface will be sought in the implementation of the Killarney Declaration, in the preparation of the EU's 7th Framework Programme and the forthcoming SBSTTA (Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention of Biodiversity (CBD) meeting (February 2005). The meeting will identify information gaps related to the aims of the Killarney declaration and identify a number of well-defined actions, resulting in an action plan that will further increase policy focus and policy relevance of the Killarney declaration. In the context of the CBD, the meeting will provide recommendations that can be directly applied to topics in discussion at the meeting of SBSTTA scheduled for February 2005.

In order to reach those aims, the e-conference, run by Bioplatfrom and chaired by Barbara Gray, had five sessions running in parallel, on the following themes:

- Biodiversity related to trade, chaired by Karin Zaunberger and Juliette Young
- Biodiversity related to tourism, chaired by Adriana Vella
- Biodiversity related to transport
- Island biodiversity, chaired by Phil Lambdon
- Science-policy interface, chaired by Patricia Wagenmakers and Sandra Rientjes

The overall conclusions from those sessions are as follows:

### **Biodiversity related to trade**

It was evident in this session that the relationship between trade and biodiversity encompasses various different sectors. These include the connection between trade and invasive species and the issue of sustainable use of resources including the wildlife trade. The transport and tourism sectors are also intrinsically interlinked with the issue of trade and biodiversity.

During the session, the following research priorities were identified by participants regarding the relationship between biodiversity and trade:

1. Identify the impacts of trade on resource management taking into account the fact that each specific management problem affecting biodiversity will need to be analysed case by case in order to determine the linkages between the key economic, ecological and institutional drivers;
2. Better understand the principles and functioning of biological invasions in order to minimise the risks of non-native species transported unintentionally and unknowingly through trade activities;
3. Develop reliable methods to detect living creatures in packing material;
4. Understand the effects of selective removal of valuable species;
5. Create a system for the traceability of genetic resources (for example barcodes);
6. Elaborate strategies to better internalise the costs of biodiversity impacts of trade;
7. Elaborate the principle of “consumer’s environmental and social liability”. An example was the inclusion of social costs arising from the cultivation of soybean in its final price;
8. Understand how to translate biodiversity events into financial terms;
9. Understand how financial decisions impact on biodiversity;
10. Understand the factors which shape the present and future market for biodiversity outcomes: a) Understand the unique characteristics of a market for biodiversity outcomes; b) Understand the processes that strengthen and sustain such a market;
11. Investigate the impact of UNCTAD’s BioTrade initiative (<http://www.biotope.org/>);
12. Understand the livelihood aspects of harvesting and trading in wildlife products;
13. Investigate the role of transportation linked with trade activities and its impact on biodiversity;
14. Investigate the specific and broad opportunities for biodiversity markets from knowledge of the properties of biodiversity products that may interest world markets to the best way to forge effective stakeholder partnerships;
15. Understand consumer behaviour and market demand for goods and services derived directly or indirectly from biodiversity: How is the demand for biodiversity currently expressed? Who experiences this demand? Which factors will most influence this demand and its visibility? Who can increase and decrease the appetite for biodiversity? Or in marketing terms, how well does the offering of the brand “biodiversity” meet this demand?
16. Create a truly integrated evidence-based mechanism for valuating ecosystems/landscapes in terms of biodiversity supported, environment services provided and potential income generated.

### **Biodiversity related to tourism**

The contributions received during the Tourism and Biodiversity session demonstrated that the topic of Biodiversity and Tourism still requires research and policy considerations and improvements. While many contributions considered and contested the extent to which tourism is of economic importance in various parts of the world, several contributors felt that the challenge in biodiversity-tourism research will include an integration of the ecological, social and economic benefits, impacts, limits to acceptable changes of these factors in relation to tourism and its carrying capacities.

The reasons why biodiversity may or may not be so important to the tourist were discussed in this session, but the indirect and direct roles of the various characteristics of

biodiversity in the tourism sector could not be dismissed. The value of biodiversity as a life supporting system, as an aesthetic/pleasure giving bonus, as the habitat/ecosystem requirements for certain charismatic organisms, as the basis for diversity in landscape and cultural uniqueness, as the necessary setting for adventure, nature, and ecotourism oriented travel may all be considered pertinent to the tourist activity. For example, many Mediterranean countries depend a great deal on their tourists for their economies. Indeed such countries may have gone a long way to alter their environment to be tourist friendly, with beautiful hotels fully equipped with all necessities and commodities, leaving very little time and space for nature appreciation outside the hotel doors.

While we all probably agree that not all tourists give much consideration to the biodiversity in the country they visit, we cannot ignore the substantial and increasing number of persons that seek to take their break from their ordinary routine life by seeking comfort or excitement, ideally in a natural and beautiful setting. Whether nature is beautiful or whether beautiful settings need to be natural may be issues for opinion surveys among tourists, but will it really target the needs of sustainable tourism? Would it really provide us with the answers we need in protecting more effectively biodiversity in regions and sites that are increasing the tourist load with no monitoring or efficient management? And what would efficient management need to take into consideration when planning and directing tourist activities in a region that needs to be shared between nature protection, social and cultural needs and economic welfare?

If indeed biodiversity is an essential component of life on earth, can we afford its loss for the quick economic profits, when research and planning (including policy implementations), may guide us toward environmentally friendly, sustainable and economically viable tourism?

Perhaps one of our prime aims or stimulus for prioritising research requirements in this tourism-biodiversity intersection needs to go beyond the important consideration of future funds available for these research needs, to focus on how current expenditures and tourism profits are directed toward or away from effective conservation of biodiversity. How can countries that have signed up to various international conventions and agreements for the protection of important habitats and species, still not consider the serious integration of various research and implementation strategies toward necessary targets such as that of sustainable tourism? This may highlight a gap in the current research arenas or call for greater collaboration between research and policy in this area to better address local and national requirements?

The national biopatform structures in certain European countries may be assisting in the latter process, while encouraging more research for faster and more effective results to address the 2010 biodiversity conservation targets. Different countries will need to address their specific research needs while integrating efforts at European and global level wherever possible. Toward this end the following research suggestions may be considered as various options that may be adopted in different countries in different circumstances, but if we need to focus on getting at the most widespread and urgent research needs what would these needs be?

1. How can we measure and monitor the impacts of tourism on biodiversity?
2. Should such research and monitoring exclude biodiversity research in favour of social science related to tourism?
3. How can research include and integrate aspects of tourism management and tourists' destination trends with biodiversity conservation?
4. How can we assess and monitor the ecological footprint of the complete supply chain of the tourism industry?
5. What aspects and characteristics of biodiversity should we measure and monitor in order to obtain the closest and reliable indication of how tourism affects biodiversity?
6. Do the perceptions, attitudes and behaviours of individuals living in or visiting a location relate to biodiversity richness or abundance?
7. To what extent have current schemes, tools, documents and legal structures put in practice effective biodiversity conservation within the tourism industry?

8. As natural environments change due to factors other than tourism, what indicators may assist us in focusing on the biodiversity-tourism interrelationships?
9. Should research focus on improving our integration of information, by using specialized software that may more closely monitor ecological/biodiversity, social and economic factors?
10. Should biological techniques such as taxonomy, play a greater role in research and management for conservation, including locations exposed to tourism?
11. What are tourism positive impacts on biodiversity and how can these be enhanced?
12. How can vulnerable habitats or protected areas be visited with minimal impacts?
13. Can and should mass tourism be changed to eco/environmentally friendly/sustainable tourism in countries where the former has been the norm and biodiversity may have already suffered?
14. How may sustainable tourism, as part of a sustainable development process, be promoted through national and international policy obligations and research monitoring?
15. How can local empowerment of sustainable tourism improve local biodiversity conservation?
16. To what extent has education and information played a role in achieving or not achieving a positive tourism-biodiversity relationship?
17. Should we focus research on the desires of tourists, on the needs of ecosystems from which tourism is obtaining a boost or on how the two aspects interact?
18. When impacts of tourism on biodiversity are clearly negative, what policies and implementations need to be addressed immediately for biodiversity conservation?

Overall research priorities may include:

1. Research on tourism policy relating to sustainability and its implementation.
2. Research on the impacts of tourism dynamics on biodiversity.
3. Research on the roles and values of biodiversity within the tourist economy.
4. Research on the limits of acceptable change for each ecosystem, habitat, landscape due to tourism.
5. Research on the way nature oriented tourism is increasing and affecting positively or negatively the locations/countries rich in biodiversity.
6. Research and monitoring of biodiversity, through the use of taxonomy as well, so as to accurately address the educational and conservation requirements of ecosystems exploited in various ways, including the tourism industry.

### **Biodiversity related to transport**

Few contributions were made to the session of biodiversity and transport. However, participants within this session cautioned against addressing transport as a separate issue, and rather encouraged us to look at the close links between the tourism, trade and transport sectors. Research priorities included:

1. Effects of transportation on biodiversity through greenhouse gases and global climate change
2. Environmental impacts of transportation, particularly as focused on travel
3. Mitigation measures to minimise road kills

### **Island Biodiversity**

The issue of biodiversity research on islands is an emotive case study provoking a high level of interest. The session has provided a focused discussion with a number of interesting responses. Clearly, there is a high level of concern over the state of island ecology at present – 12 contributors voiced a high level of urgency, and several described a wide variety of pressing threats to be addressed, both to ecosystems and to individual taxa. Most of the debate was from a European perspective, although a few contributors were able to provide a more global overview.

Our essential question was: How can we make biodiversity research more relevant to policy? A variety of solutions were advanced, although these fell into a few major themes:



1. Quantification of existing biodiversity (6 calls)
2. Better understanding of genetic diversity within species (2 calls)
3. More research into ecological interactions within ecosystems (4 calls)
4. Research into the effects of human degradation of the environment (4 calls)
5. Research into the problems posed by biological invasions (5 calls)
6. Development of sustainable management practices (5 calls)
7. Conservation-orientated studies of threatened species (2 calls)
8. Development of understanding of social attitudes to biodiversity (2 calls)
9. Prediction of the consequences of global change for island ecosystems (2 calls)
10. Research into the problems of overexploitation of natural resources (1 call)

Opinions were well balanced between the European and global perspectives.

The most frequent wish was for more basic auditing of current biodiversity. Many taxa remain poorly known, and a common call was 'how do we know what the problem is if we do not yet know what is there'? The problem was felt to be exacerbated by a loss of taxonomic skills and a decline to unfashionable status in the eyes of non-ecologists. However, one suggestion advanced was that such basic information would help to indicate biodiversity loss in the face of global change.

These themes encompass a wide-range of priorities, which, as yet, are far from representing a consensus view. This is a reflection of the complexity of the issues involved and how much remains to be done. Some participants emphasized the need for understanding interactions within the ecosystems, such as the ecology of endemic reptile populations, or the dynamics of pollinator-plant systems within natural communities. One example showed how even moderate levels of fishing in the Fijian islands has had pronounced changes to local reef communities. This type of study is essential for the conservation of species, which are already critically threatened. It will also be valuable to develop models, that can predict the consequences of global change.

Immediate pressing problems demand immediate attention, and therefore environmental threats attracted vocal support for more research. The issues most discussed surrounded biological invasions and tourism. However, these problems are heavily interlinked, and the benefits of greater interdisciplinarity between these traditional divisions was stressed by one contributor.

There was a general feeling amongst some contributors that not enough money is being diverted to tackling environmental questions in relation to their importance to global sustainability. However, pragmatism necessitates a positive outlook, and this highlights the importance of using available resources efficiently. One point made was an impression of a shortage of ground-level research in order to parameterise models and provide data for databases. There seemed to be some consensus in that field-studies were overwhelmingly demanded, and there was also an absence of calls for metadata studies. However, the value of modelling as a complimentary tool was emphasized, for example in its value for understanding the biology of threatened turtle populations.

Social engagement with biodiversity has probably been somewhat neglected in the past, but undoubtedly holds a major key to achieve the implementation of changes, as was highlighted in at least two contributions. One view was that we should market our science better in order to raise the profile of biodiversity issues. Cross-communication between science and policy was suggested as another area where improvements could be made. Integration of theoretical and applied research was viewed as sometimes ineffective. This was illustrated with issues such as reserve design in the Canary Islands, where some designations may not be effectively protecting enough important habitat and species. Another case was the potential impacts of removal of trade barriers on Malta, where the potential environmental impacts may have been deferred to the desire for political change.

Island biodiversity is an asset, which is currently under imminent threat, and the need for more research is not greatly disputed amongst concerned stakeholders. However, there are many areas of study, which need to be addressed. Whilst priorities for research vary considerably from different perspectives, four key areas have emerged as of particular importance:

1. Auditing the state of island biodiversity
2. Improving knowledge of ecological interactions in threatened habitats
3. Focused studies tackling environmental threats, especially invasions, urbanization and tourism
4. Dealing with the human element - integrating science into policy.

Whilst there is still much scope for discussion within these broad topics, it provides a step towards a framework, which may be useful in guiding the forthcoming debate.

### **Science-Policy interface**

We had an invigorating and far-reaching discussion during this session about numerous aspects of the science/policy interface. The conversation suggests that all contributors are working in a highly complex domain whose multiple constituents are characterized by considerable diversity in scientific disciplines, methodologies, relevant audiences, reward and incentive structures, time frames, levels of influence (local, national, EU, global), priorities, not to mention personal persuasions. In addition, the biodiversity domain is fraught with uncertainty, which complicates research and policymaking tremendously.

Nonetheless, several constructive threads of conversation were initiated and we began a rich exploration of them. A preliminary list of research priorities stemming from these discussions is as follows:

1. The need for scientists and policy makers to better understand the way each “frames” the other and to get beyond the stereotypical impressions that often characterize their interactions.
2. Facilitation of widespread agreement about and dissemination of a scientifically sound and practically validated definition of biodiversity and the construction of data-backed indicators that can be used as input to policy making.
3. The need to find ways to reconcile policy makers’ and NGOs’ needs for “timely” input from researchers with researchers’ need for longer time horizons to plan and conduct valid and reliable research.
4. Development of a new cadre of taxonomists and attention to generating and influencing funding to support the development of this career path.
5. Development of respected scientific biodiversity databases that can be shared among researchers.
6. Interdisciplinary debate among researchers that foster respect for (rather than discrediting of) the variety of legitimate approaches to the study of biodiversity within the research community and may even generate valuable interdisciplinary research.
7. Deliberation about the proposed creation of an overarching institution at the EU level to generate scientific recommendations for EU policy makers. The question is whether or not this function is already satisfactorily provided by existing institutions (such as EPBRS, Networks of Excellence, DIVERSITAS etc.)
8. Stimulation of National Biodiversity Fora to bring science and policy together at national levels. As above, this function may, in many countries, be provided by existing initiatives, such as the national biodiversity platforms, many of which are linked to EPBRS and currently supported by the BioPlatform project.
9. Educating and influencing local communities and their stakeholders to consider the impact of their land-use decisions on biodiversity.
10. The need to develop a variety of highly participative forums that promote rich debate and learning among stakeholders and allow collaborative solutions to emerge through compromise and/or consensus building.
11. The construction of incentives to encourage local communities and particularly developers, transportation agencies and others who are disrupting the landscape to pay attention to the biodiversity impacts of their actions and to find approaches for getting the most cost-effective restoration of terrestrial biodiversity at local levels.
12. Increasing the amount of available research funds that are directed to biodiversity research (through lobbying, input into the 7th Framework Programme, finding other

sources, finding creative ways to engage business in supporting biodiversity research, etc.)

13. Consideration of what role scientists can play in enlarging public discussion and awareness of biodiversity issues (especially given the lack of institutional incentives and rewards for such activities by academic researchers).
14. Sharing of successful examples/methods for promoting constructive interfaces among biodiversity researchers, NGOs and policy makers.



## List of contributions

<b>Title of contribution</b>	<b>Name of contributor</b>
<b>Trade and biodiversity session</b>	
Introduction to the Biodiversity and Trade Session	K. Zaunberger, Chair
Trade and biodiversity	J. McNeely
Soy expansion in the Brazilian Amazon Region as a local and global dilemma	R. Muradian
What exactly is the market for biodiversity?	T. Kitchin
Linking trade and biodiversity: Making conservation work for growth	L. Assuncao
Wildlife trade- priorities for research	S. Oldfield
How can trade in known pests be controlled?	J. Reynolds
RE: How can trade in known pests be controlled?	M. Sharman
Trading of genetic material	T. Dedeurwaerdere
RE: Trading of genetic material	T. Kitchin
Certificates of origin for genetic resources and international trade law	S. Louafi
Trade and biodiversity questions	M. Sharman
RE: Trade and biodiversity questions	T. Kitchin
RE: Trade and biodiversity questions	J. McNeely
RE: Trade and biodiversity questions	J. Jansen
RE: Trade and biodiversity questions	R. Kenward
RE: Trade and biodiversity questions	T. Kitchin
RE: Trade and biodiversity questions	J. Seppala
Initial trade and biodiversity research priorities	K. Zaunberger, Chair
RE: Initial trade and biodiversity research priorities	J. Dick
<b>Tourism and biodiversity session</b>	
Introduction to the biodiversity and tourism session	A. Vella, Chair
Biodiversity, the scientific basis of tourism	F. di Castri
What are the main research questions?	M. Sharman
RE: What are the main research questions?	M. Agnoletti
RE: What are the main research questions?	L. Rossi

Biodiversity research: the key to achieving sustainable tourism	J. Shores
Sustainable tourism	E. Yunis
Tourism and biodiversity	D. Weaver
RE: Tourism and biodiversity	F. Boero
Yes, but...	M. Sharman
RE: Yes, but...	R. Kenward
RE: Yes, but...	F. Boero
RE: Yes, but...	M. Sharman
RE: Yes, but...	F. Boero
Now I've got it- beauty counts!	J. Marcin Weslawski
RE: Now I've got it- beauty counts!	F. Boero
More on biodiversity and tourism	J. Marcin Weslawski
RE: More on biodiversity and tourism	M. Agnoletti
Livestock and citizens: the Balearic experience	C.R. Altaba
More natural Science in socio-economy of tourism needed	J. Marcin Weslawski
Involving GIS in integral conservation of natural values of Tara NP (Serbia and Montenegro)	D. & I. Radovic
Rural tourism	C. Kleps
Biodiversity: Carrying capacity and management	D. Kaplan
Ecotourism and ecolodge development around the world in the 21st century	H. Ceballos-Lascurain
Tourism and biodiversity: A key role for environmental management	D. Kaplan
Tourists' perception of coastal values	M-F. Jedrzejczak
Tourism as a tool and a threat	R. Buckley
Taming the superlatives	J. Shores
Limits of Acceptable Change	J. Shores
Tourism and biodiversity research priorities	R. Dodds
Biodiversity and tourism in Romania	S. Mihailescu
Tourism and biodiversity questions	M. Sharman
RE: Tourism and biodiversity questions	E. Berge
RE: Tourism and biodiversity questions	J. McNeely
RE: Tourism and biodiversity questions	R. Mader
More on the 10 Million Euro issue	J. Marcin Weslawski
RE: More on the 10 Million Euro issue	F. Boero
RE: More on the 10 Million Euro issue	A. Franklin
RE: More on the 10 Million Euro issue	F. Pugnaire
RE: More on the 10 Million Euro issue	M. Sharman
RE: More on the 10 Million Euro issue	A. Franklin
RE: More on the 10 Million Euro issue	H. Segers
The last contribution from Ferdinando	F. Boero
RE: The last contribution from Ferdinando	F. Uiblein
Social carrying capacity in tourism	S. Marzetti
Biodiversity Protection through Community Ecotourism in the Ecuadorian Chocó	M. Finn
Tourism and biodiversity session research priorities	A. Vella, Chair
Slide on tourism and biodiversity	C.R. Altaba
<b>Transport and biodiversity session</b>	
Trade and transport: The missing link	J. Shores

Strategy and mitigation measures for reducing roe deer-vehicle collisions in Slovenia	B. Pokorny
Environmental Impact of Transportation	R. Mader
<b>Island biodiversity session</b>	
Introduction to Island Biodiversity session	P. Lambdon, Chair
Island development	G. Baldacchino
Some notes on the Mediterranean island herpetofauna	C. Corti
Canarian biodiversity under threat due to a non-sustainable development model	J-M. Fernandez-Palacios
Plant biodiversity in Sardinia	G. Brundu
Island Biodiversity conservation: some research priorities	J. Palmeirim
Alien species and island biodiversity	P. Schembri
Taxonomy urgently needed for islands	C.R. Altaba
Consequences of biological invasions for plant-animal mutualisms in island ecosystems	A. Traveset
The role of species attributes on invasion of Mediterranean islands by alien plants	F. Lloret
Biodiversity issues in the Azores	P. Borges
Social aspects of biodiversity policy in the Mediterranean	D. Bardsley
Assessing the ecological state of the Mediterranean: a need for baseline monitoring	P. Lambdon, Chair
Island biodiversity questions	M. Sharman
Question to answer	P. Borges
Sustainable management of insular biodiversity	P. Feldmann
RE: Island biodiversity questions	J-M. Fernandez-Palacios
RE: Island biodiversity questions	F. Boero
RE: Island biodiversity questions	F. Rauschmayer
RE: Island biodiversity questions	P. Lambdon, Chair
RE: Island biodiversity questions	R. Kenward
RE: Island biodiversity questions	E. Koutrakis
RE: Island biodiversity questions	P. Lambdon, Chair
RE: Island biodiversity questions	F. Uiblein
Capacity building for conservation	D. Bardley
Recent marine extinctions	N. Dulvy
RE: Recent marine extinctions	M. Nasir
Fiji island coral biodiversity and fishing	N. Dulvy
Ecological modelling as a tool for upgrading conservation	A. Mazaris & Y. Matsinos
Sacred islands	S. Jones
Island biodiversity session summary	P. Lambdon, Chair
<b>Science-Policy interface Session</b>	
Introduction to the Science and Policy Session	S. Rientjes, Chair
Problems of the science-policy interface	F. Wätzold
RE: Problems of the science-policy interface	K. Perzanowski
RE: Problems of the science-policy interface	I. Karakassis
RE: Problems of the science-policy interface	F. Boero
RE: Problems of the science-policy interface	R. Muessner
Biodiversity committee	A. Feest
RE: Biodiversity committee	F. Boero
RE: Biodiversity committee	A. Feest

RE: Biodiversity committee	F. Boero
RE: Biodiversity committee	S. Knapp
Biodiversity indicators and the science-policy link	B. Delbaere
RE: Biodiversity indicators and the science-policy link	A. Feest
RE: Biodiversity indicators and the science-policy link	B. Delbaere
RE: Biodiversity indicators and the science-policy link	R. Muessner
Interdisciplinarity in conservation	S. Renner
Multidisciplinary approach- the wet heaths example	J. Jansen
Efficient use of knowledge and new structures	C. Nesshoever
RE: Efficient use of knowledge and new structures	K. Török
Science-policy interfaces for biodiversity governance	S. Van den Hove
RE: Science-policy interfaces for biodiversity governance	F. Rauschmayer
Thinking local and of all the users	R. Kenward
NBPs	C. Nesshoever
Problems of the science-policy interface	B. Gray, Chair
Council of scientific advisers for European biodiversity	F. Wätzold
The role of NBPs in bridging science and policy- an example from Bulgaria	D. Dimitrova
Discussion observations	B. Gray, Chair
RE: Discussion observations	S. Van den Hove
RE: Discussion observations	B. Delbaere
RE: Discussion observations	A. Vadineanu
Funding questions	K. Zaunberger
RE: Funding questions	F. Boero
RE: Funding question	T. Kitchin
RE: Funding questions	M. Sharman
RE: Funding questions	A. Feest
RE: Funding questions	J. Jansen
RE: Funding questions	S. Van den Hove
RE: Funding questions	P. Fernandes
Partnerships to build a national directive	M. Gosselin & J-M. Brezard
RE: Partnerships to build a national directive	S. Van den Hove
RE: Partnerships to build a national directive	F. Gosselin
Some conditions that could promote science/policy interaction	F. Gosselin
Efficient use... and new structures	J. Wiertz
Species interaction- crucial and usually overlooked parts of biodiversity	A. Vrezec
Science-policy interface	P. Fernandes
Dealing with pros and cons?	T. Cerny
Passing messages	M. Sharman
RE: Passing messages	G. Lovei
RE: Passing messages	F. Rauschmayer
RE: Passing messages	R. Moritz
What is a scientific fact?	G. Lovei
Learning from other disciplines	A. Pullin
Summary of priorities and concluding comments	B. Gray, Chair



## Biodiversity and Trade

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## **Biodiversity and trade session introduction**

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**Karin Zaunberger**, Session Chair, European Commission, Management of Natural Resources and Services - Biodiversity Sector, Brussels, Belgium

The aim of this session is to identify knowledge gaps and research priorities in the relationship between biodiversity and trade.

Trade has an enormous impact on biodiversity. Part of the impact is direct, for example the trade in wild species or products derived from them. Part is indirect, for example when trade gives incentives for changes in land cover and land use. Trade may provide routes for species to establish themselves in new areas, where some may become invasive. Assessment of these impacts is vital for informed decision making.

Arguments in favour of conservation, however, may sometimes be viewed as camouflaged barriers to trade. In this way, issues related to trade may become important in multilateral environmental negotiations. During the 7th Conference of the Parties to the Convention of Biological Diversity (COP7), for example, some decisions were nearly blocked because various parties felt that they would unfairly interfere with trade.

Consumers, investors, governments and NGOs increasingly expect that markets and business should alter their social and environmental behaviour in ways that would have a positive impact on biodiversity. New definitions and standards of corporate social responsibility and a variety of legal and policy responses have been developed.

Can we replace this biodiversity / trade conflict with something more positive? Could trade, and the markets it supplies, function more sustainably? How could companies manage biodiversity in their operations? How might one develop new business based on conservation and sustainable use of biodiversity? What is the role of governance? Can the negative impact of trade be lessened by green markets and “fair” trade or links between banking, investment and biodiversity? What is the role of the private sector in sharing the investment costs for biodiversity conservation, and, as a stakeholder, making trade and investment liberalization sustainable?

## Trade and biodiversity

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Jeff McNeely, IUCN

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**SUMMARY:** Trade is a critically important issue for all of us. We are utterly dependent for our very survival, or at least welfare, on harvested natural resources from some of the most volatile parts of the world, causing our governments to make substantial military expenditures to keep the whole system functioning. Some people may have their doubts, but the consensus in most parts of the world is that global trade is, on balance, a good thing and a key component of sustainable development, even if it often seems that the benefits flow disproportionately in favour of those who are already well off. But what are the impacts of trade on biodiversity?

**KEYWORDS:** Institutional context, non-native species, specialisation, internalisation.

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First, the institutional context of the resource management regime is essential. All depends on whether the harvested resource is being managed with a view toward optimal use, or whether it is simply open access to earn quick income. Renewable natural resources - forests, fisheries, crops- are inherently dynamic, often affected by unpredictable variables such as climate or rates of replenishment; and complex environmental issues surround resource extraction, including non-use values, ecosystem services, invasion of non-native species, and conversion of productive habitats to less productive alternative uses. Further, many of these resource systems have people who may have been living within them for several generations or more, but are not always fully involved in the decisions about how these resources are to be exploited today. Because the impacts of resource extraction on biodiversity are felt locally, those involved in global trade disclaim any responsibility for the mode of production or transport. They simply accept as a matter of faith that the responsible governments will ensure that any environmental costs are incorporated into the prices that are charged for the commodities traded. Small wonder that the international community is willing to leave such issues up to the national governments.

Instead of a general policy solution, each specific management problem affecting biodiversity will need to be analysed case by case in order to determine the linkages between the key economic, ecological, and institutional factors that are driving the problem. By identifying the impacts of trade on resource management, biodiversity and economic welfare, the possible policy remedies can be recommended to governments and possibly to the WTO, CBD, and CITES as well.

Whether trade is good or bad for biodiversity and welfare depends on the interplay of complex economic, ecological, and institutional factors. Policy options and recommendations can also be expected to reflect the complexity of the issues involved, arguing against any simple answer supporting or opposing free trade. Instead, full consideration needs to be given to the wider ecological and economic links that provide the foundation for trade, natural resource management, and assessing the impacts of these on biodiversity.

Another externality of trade is the impact on biodiversity of non-native species transported by trade. If these are beneficial, or at least harmless, no problem arises. But if they proliferate in their new home and spread in ways that are contrary to human health, economics or the environment, then a serious problem arises. If the species is being introduced intentionally, then existing mechanisms such as environmental impact assessment can readily be used. But far more insidious are the thousands of species that are unknowingly in motion at any one time, in the ballast water of freighters or navy vessels, as egg masses of insects in log shipments, in the form of mosquito larvae trapped in shipments of used tires, or even viruses carried by unsuspecting travellers. Invasive species cost countries around the world several hundred billion dollars per year biodiversity-related damages, calling for a far more effective policy response.

One final impact of trade on biodiversity that passes generally unnoticed is that it promotes specialisation in production, leading in turn to specialisation in ecosystems and their

associated biodiversity. The conversion of large areas of highly diverse tropical rain forest into mono-specific stands of oil palm, rubber, or coffee, makes the point dramatically in various parts of the tropics. Biodiversity certainly suffers in such a case, and when the systems being simplified are ones that are of recognised global importance because so many of their species are found nowhere else, then a vigorous public policy response is appropriate. This is again an example of a hidden externality; a tony Parisian sipping her demi-tasse of espresso is hardly aware that a unique patch of rainforest in Madagascar, containing species that are found nowhere else in the world, has been destroyed so that she can have her caffeine jump-starter each morning.

Ultimately, it is all a question of feedback: how can markets better internalise the costs of biodiversity impacts of trade. This issue is of great, and growing, importance as biodiversity continues to be lost at an alarming rate, driven in part by growing resource consumption driven by trade.

## **Soy Expansion in the Brazilian Amazon Region as a Local and Global Social Dilemma**

**Roldan Muradian**, Development Research Institute (IVO), Tilburg University, and **Clara Whyte**, Former consultant WWF-Brazil

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**SUMMARY:** The authors argue that the environmental and social costs arising from the cultivation of soybean should be internalised based on the principle of “consumer’s environmental and social liability” and describe an international institutional framework that would allow the strengthening of local institutions in charge of monitoring and preventing deforestation, as well as in those dealing with capacity building and economic diversification.  
**KEYWORDS:** Soybean, deforestation, market failure, sustainability.

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Despite liberalizing trade and investment regimes, the Brazilian economy grew at very low rates during the 1990s (0.36 % GDP per capita on average). In spite of this meager overall performance some export sectors have shown a remarkable boom. For example, the volume of soybean exports multiplied by 3.7 from 1985 to 2003. From 1995 to 2001, soybean exports to the UE increased by 203 %. This process has brought considerable economic benefits to the regional economies. However, the expansion of the soybean frontier encompasses considerable deforestation of the Amazonian forest. This occurs even though, according to Brazilian federal regulations, the “legal reserve” of native vegetation that must be maintained in private lands equals 80% of the property in forested areas. The expansion also has important social consequences on the local communities of small subsistence farmers unable to cope with the process.

As most of the soybean production is delivered to a few trans-national corporations, namely to Archer Daniels Midland, Bunge, Cargill and Louis Dreyfus, that dominate the trade and processing nodes of the commodity chain, the soybean frontier expansion into the Amazon forest constitutes a typical example of environmental degradation and rural social exclusion exacerbated by global economic integration in a context of weak institutions (in this case, unable to enforce the law). Since the Amazon forest provides a large variety of environmental services at the local, regional and global level, forest loss produced by uncontrolled expansion of soybean cultivation may generate large environmental and social externalities (economically not accounted environmental and social impacts). This kind “market failure” may be prevented if these externalities are “internalised”. That is, if additional environmental and social costs arising from the cultivation of soybean are included in its final price, based on the principle of “consumer’s environmental and social liability”.

How could the European Union move into the application of policies dealing with biodiversity loss and rural social exclusion linked to European consumption through global commodity chains? In the case of the expansion of the soybean frontier the most cost-effective way seems to build up an international institutional framework allowing to invest part of the value added generated in the soybean chain in strengthening local institutions in charge of monitoring and preventing deforestation, as well as in those dealing with capacity building and economic diversification. This will imply international redistribution of resources, since the nodes of the chain where value added is accumulated are located closer to final consumption. Such effort will require also international coordination, as well as coordination between different agents of the chain, since price distortions (for internalising environmental and social externalities) may affect the competitiveness and economic performance of the sector.

Please note that a “Global Roundtable on Sustainable Soy” will take place on March 10 & 11, 2005 at the Hotel Bourbon in Foz do Iguaçu, Brazil. It is a common initiative of both civil society organizations and private corporations. A homepage [www.sustainablesoy.org](http://www.sustainablesoy.org) is under preparation and will be accessible soon.

## What exactly is the market for biodiversity?

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**Tim Kitchin**, Glasshouse Partnership

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**SUMMARY:** If biodiversity is to be successfully protected within a market-led global economy, its custodians must apply the disciplines of marketing - beginning by understanding the market demand for biodiversity.

**KEYWORDS:** Biodiversity, economy, biodiversity outcomes.

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Economic Capitalism and Biodiversity are the two critical systems which govern the pace and limits of human progress. However the two frameworks are currently disassociated. There is minimal dialogue between them, and only fragmentary mutual understanding. This has two causes: Biodiversity events have never been clearly translated into financial terms, preventing effective financial accountability, and financial decisions have never been clearly translated into biodiversity impacts, denying true environmental accountability.

Historic attempts to connect the two systems have been sporadic and generic, and have often been driven by regulation and compliance (see note a. below). Such approaches are doomed to failure within a growth-driven, free-market system where transactional accountability is a pre-requisite.

Unless these two mega-systems can work effectively together, with mutual accountability, progress within one paradigm will almost inevitably come at the expense of progress in terms of the other (see note b. below).

The 21st century imperative is therefore to make biodiversity decisions amenable to the mechanisms of the economic market, enabling the marketplace to effectively value long-term outcomes. An effective, biodiversity-literate marketplace would empower both governmental, corporate and consumer decision-makers to respond to a growing body of biodiversity insight, as it emerges over the coming decades.

From a human perspective, we can think of biodiversity as “the system of systems which sustain life”. As such it should never be in conflict with capitalism, but should embrace capitalism as an efficient means of valuing future outcomes in the here and now.

If an effective market for biodiversity is to come into being, market participants (see note c. below) must be able discriminate between constructive and destructive decision-outcomes.

All markets rely upon the exercise of discrimination between available options. They must therefore be able to allocate values against these outcomes – transparently.

If biodiversity is to operate as a discriminator within a free market, the market must therefore offer:

- Information: the facts about the intrinsic and extrinsic biodiversity impacts of a product or service offer
- Context: a robust framework for comparison between options, including values-based terms of reference.
- Accountability: the ability to withstand scrutiny from all legitimate stakeholders.

There are two core needs:

1. To understand the unique characteristics of a market for biodiversity outcomes.
2. To understand the processes required to grow and sustain such a market.

In the first instance, the academic and commercial research should focus first and foremost on item 1. above – i.e. on understanding the unique nature of the demand-chain for biodiversity. How is the demand for biodiversity currently expressed? Who experiences this demand? Which factors will most influence this demand (and its visibility)? Who can increase and decrease the appetite for biodiversity? In marketing terms, how well does the existing offering of brand ‘Biodiversity’ meet this demand?

Notes:

- a) It can be argued that there has been minimal progress in answering point 1 above (Translating Biodiversity => Economics), with only limited victories achieved in the

form of carbon emissions trading, and through current efforts to quantify environmental risk as part of corporate risk management strategies.

Meanwhile, we have witnessed a tidal wave of parallel reporting standards (AA1001, ISO14001, GRI...) that have created a meta-language somewhere between the two systems, but do not actually connect them. The potential of these reporting languages to motivate corporate biodiversity-behaviour needs deeper investigation.

Point 2, (Translating Economics => Biodiversity) has been almost entirely neglected. Activist-driven efforts have resulted in the creation of numerous production standards (MSC, FSC, Organic, Red Tractor etc), and these have gradually been embraced by retailers, making a real difference to market behaviour. However, the extent and nature of their actual environmental impact remains unknown. The true meaning and administration of the standards remains opaque to many of their stakeholders.

b) In the most pessimistic scenarios, either capitalism will consume biodiversity and precipitate global anarchy, or the rapid loss of biodiversity will precipitate a pre-emptive return to totalitarianism as a means of direct resource control.

c) Participants include consumers, governments, and businesses. However the driving force of global commerce is consumer demand. It is at the consumer level that research-insight is likely to yield most benefit, in contrast to today's focus on corporate-level accountability.

## **Linking Trade and Biodiversity: Making Conservation Work for Growth**

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**Lucas Assuncao**, Coordinator Climate Change and BIOTRADE Initiative, UNCTAD, Palais des Nations, Switzerland

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**SUMMARY:** The author describes the BioTrade initiative, developed to support sustainable development through trade and investment in biological resources in line with the three objectives of the CBD.

**KEYWORDS:** Sustainable development, biodiversity markets, private sector, stakeholders.

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Developing countries face a great challenge. They must simultaneously conserve biodiversity and grow economically to alleviate poverty and generate jobs. The trade of products and services derived from biodiversity can be part of the solution. Market interest for biodiversity products and services is growing, giving biodiversity-rich countries a comparative advantage. However, most products are used for subsistence or are traded locally, and relatively few products enter the larger domestic and foreign markets. Developing countries often lack the capacity to turn biodiversity into a competitive advantage. To overcome this hurdle UNCTAD established the BioTrade Initiative.

UNCTAD's BioTrade Initiative supports sustainable development through trade and investment in biological resources in line with the three objectives of the Convention on Biological Diversity (CBD). BioTrade refers to those activities of production, transformation, and commercialisation of products and services derived from biodiversity that involve practices supporting conservation and sustainable use of biodiversity, and that are generated taking into account ecological, social and economic criteria.

Examples of BioTrade products include medicinal plants, exotic fruits and seeds. These are used as ingredients for an \$18 billion worldwide market in an increasing number of consumer goods, such as phyto-pharmaceuticals, cosmetics, and dietary products. Intermediate products, such as essential oils, natural dyes, latex, fibres, resins, gums and medicinal plants; account for roughly \$3 billion in US imports and exports. Most of these products are not necessarily produced in a sustainable manner as yet, but there is increasing consumer and industry interest to differentiate products by meeting quality and health safety standards as well as sustainability criteria.

In order to assist developing countries in getting their biodiversity products into world markets, UNCTAD's BioTrade Initiative believes it is necessary to:

- Create an enabling policy environment at the national, regional and international level that promotes sustainable trade in biodiversity products and services;
- Enhance supply capacity in developing countries for the sustainable production and commercialisation of biodiversity goods and services. This entails: increasing productivity levels, strengthening technical skills, improving physical infrastructure, augmenting access to finance, and promoting active partnerships among relevant stakeholders;
- Improve market access and forge market creation for biodiversity goods and services, including enhancing the understanding of the market, facilitating commercial contacts, and raising awareness among consumers.

In their attempts to overcome barriers to market access for BioTrade products, private sector companies face several challenges, including:

- Quality and safety standards that increase constantly
- Lack of adequate infrastructure, transportation and managerial skills, and information about market structures
- Lack of private capital either as credit or equity investment
- Inappropriate policy frameworks conducive to trade and investment in biodiversity-based products and services.
- Limited skills to address the whole supply chain (e.g. collection, processing, manufacturing, certification, sales)

- Limited engagement into partnerships among key interested stakeholders, including government agencies, private sector associations and companies, NGOs, local producers, and international organisations
- Unarticulated system for accreditation and certification of biodiversity products
- Inadequate market access for emerging economies produce (trade rules are being negotiated on IPRs, ABS, TK without taking into account major supply side and policy constraints)

Food for Thought: Bio trade is an effective way of making sustainable development a reality. The biodiversity market is growing yet biotrade is still in its infancy. Research is needed into both the specific and broad opportunities for biodiversity in markets: from knowledge of the properties of biodiversity products that may interest world markets to the best way to forge effective stakeholder partnerships.



## **Wildlife trade - priorities for research**

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**Sara Oldfield**, Fauna & Flora International

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**SUMMARY:** The trade in wild species and their parts and derivatives is big business worth billions of dollars each year. The EU is a major consumer of wildlife products from around the world. The nature of the global trade is complex and poorly understood (Broad, Mulliken and Roe, 2003). The impact of wildlife trade on species and their habitats is often perceived to be negative, but if sustainably managed, the benefits of the trade can provide positive incentives for biodiversity conservation.

**KEYWORDS:** Wildlife trade, baseline data, socio-economic research.

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In reality there are few relatively proven examples of sustainable harvesting of wildlife products for international trade. Well-documented case studies are needed as called for at an international workshop held in Vilm, Germany in April 2004, which looked at harmonisation and synergies between two major international biodiversity agreements CITES and CBD (Stolpe and Fischer, 2004). The ecological, economic and social factors that enhance sustainability need to be researched and analysed as a basis for developing management guidelines to support the implementation of both Conventions.

The impact of wildlife trade on biodiversity remains poorly understood. At a species level there is incomplete knowledge of which species enter into trade, and to what extent the level of trade is damaging. Target 11 of the CBD Global Strategy for Plant Conservation agreed in 2002 calls for “No species of wild flora endangered by international trade”. Research and data collation is required to provide baseline data on the scope of this ambitious target, to find out for example which species are in trade and why. Even where plant species are classified as Endangered and are recorded in trade it is often not clear to what extent harvesting is a significant threat as compared with pressures of habitat modification and destruction.

At an ecosystem level, more research is required to establish what the effects are of selective removal of valuable species both in terms of impact of the harvesting process itself and on understanding the role that the species plays within ecosystem functioning.

Increasing attention is being paid to commercially valuable timber and fish stocks in discussions of wildlife trade and biodiversity conservation. This is much needed given the scale of the trade and the reported declines in forest and marine resources. The international timber trade, for example, is characterised by a wide range of products derived from hundreds of different species, the conservation status of which is often poorly known. To a large extent the timber trade still relies on the harvesting of wild material from natural forests. Policies, Criteria and Indicators and Standards for sustainable forest management have been developed and agreed but generally autecological, forest inventory and regeneration data for species is very limited or totally lacking.

Basic botanical and ecological research is needed to ensure that trade in the wide variety of wild plants harvested for medicinal, timber, food, ornamental horticulture and other purposes is sustainable and not damaging to wild populations or the wider ecosystem. The same is true for fish and many other animal products. At the same time socio-economic research is equally and fundamentally important to understand the livelihood aspects of harvesting and trade in wildlife products. Policy decisions regarding wildlife trade taken in international fora can have far-reaching implications for local people who are dependent on the income from a sustainable trade.

## **How can trade in known pests be controlled?**

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**Julian Reynolds**, Laboratoire de Génétique et Biologie des Crustacés, Université de Poitiers, France and Department of Zoology, Trinity College, University of Dublin

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**SUMMARY:** The European Union is based on free trade, and it has been difficult to control trade in known aquatic pests. As a result, many plants (such as *Jussia*) and animals (such as American crayfish) are widespread and costly to control. Measures to control known or suspected pests appear inadequate, resulting in both economic and biodiversity costs.

**KEYWORDS:** Alien crayfish, *Jussia*, *Dreissena*, control, biodiversity loss, European Union.

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Many aquatic ecologists see introduced species as a major threat to ecosystem integrity, to an even greater extent than terrestrial. Among many examples such as the trade-related accidental spread of the zebra mussel *Dreissena* spp across Europe and the United States, or the introductions of the nuisance weed *Jussia* spp to natural wetlands in France, I would focus on the probably intentional release of traded live Louisiana crayfish *Procambarus clarkii* into wetlands of Spain, France and Italy on a number of occasions. This species can legally still be traded live in the European Union. There are now three American species of crayfish widespread in Europe, at a major cost to biodiversity (Holdich & Gherardi, 1999), and they have displaced the three native species to such an extent that all three are now on Red Lists of vulnerable and threatened species and Annexes of Bern Convention and Habitats Directive of the European Community. The mechanisms by which they have succeeded are now well known (see, for example, Reynolds and Souty-Grosset, 2003), and include superior competitive skills and carrying lethal fungal diseases. However, only Ireland among EU countries has so far succeeded in preventing importations of exotic crayfish. Estonia, the only other EC country without alien crayfish, is considering how to implement such a ban. Legal opinion, however, continues to say that such bans may be considered as barriers to trade within the European Union.

I was therefore interested to see Jeff McNeely of IUCN say that if a species known to be detrimental is being introduced intentionally, then 'existing mechanisms such as environmental impact assessment can readily be used'. It seems to me that this is only feasible in the case of large-scale planned developments, such as a large crayfish farm. However, most plant and animal introductions are the result of diverting live importations intended for gardens or as food to illegally stock waterways, regardless of the consequences. Crayfish can survive for days out of water, and the only control possible is to ban live imports, as Sweden has at last succeeded in doing.

In the forum on Island biodiversity, Patrick Schembri expressed his concern that Malta has lost its existing controls on the importation of alien species following its recent accession to the European Union, and already garden centres, aquarists and many private individuals have imported a variety of alien plants and animals, several of which are destined to escape. It is likely that there are known pests among them.

I therefore believe that EIA is not an adequate mechanism for controlling introductions of known pests of aquatic systems, and that within the European Union free trade will usually win out over ecological considerations. I hope that other contributors can supply further information on how to deal with this urgent topic, which impacts on successful implementation of the Habitats and Water framework Directives.

## **RE: How can trade in known pests be controlled?**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

In an earlier message I suggested that we needed to research the true costs of invasive organisms. By coincidence, in an article "Ashes to Ashes" in this week's *The Environmental Magazine* (<http://www.emagazine.com/view/?2102>), Bob Wyss reports that the emerald ash

borer (*Agrilus planipennis*) arrived in Detroit five years ago in wood packing material aboard a cargo ship from Asia. Since then it has caused the Michigan nursery industry at least \$10 million in damages, and the U.S. Department of Agriculture has spent \$54.3 million to try to control the insect. Some say that it may prove necessary to burn every ash tree in parts of Michigan, Ohio and Indiana. A nursery owner has been fined \$12,300 for shipping contaminated trees to Virginia in violation of quarantine. Whatever was in that Asian box, it probably wasn't worth \$65 million. But wouldn't it be great if we had \$65 million to spend on developing rapid and reliable methods to detect living things in packing material?

## Trading of genetic material and consequences to biodiversity

**Tom Dedeurwaerdere**, Université Catholique de Louvain and Fonds National de la Recherche Scientifique, Belgium

**SUMMARY:** In this contribution we argue for a balanced approach to certificates of origin that is cost-effective both for the industry - at the end of the pipeline - as for the bio-collectors in the beginning of the pipeline.

In this keynote contribution, we would like to open the discussion on an economic and legally sound approach to a system of certificates of origin, actually discussed in several international fora. As the proposal has been discussed elsewhere, we would like to contribute here to the discussion with two ideas that are key to the implementation of such a proposal.

a. Preliminary remarks on the objectives of the system: The idea is to create a system for the traceability of genetic resources (where they come from, where they are going), as an essential element for implementing the objectives of the CBD. So it is an interim mechanism for facilitating the implementation of the CBD, and most prominently the ABS requirements of the Convention. The best way in which to conceive of it is as a tool that is a necessary building block of an international regime, that different stakeholders can use in a flexible manner, whether it be in material transfer agreements, in patent applications or in the process of product approval for commercialisation.

b. Towards a balanced system: two policy proposals. In order to create a cost-effective system, one needs a balanced approach that is cost-effective both for the industry - at the end of the pipeline - as for the bio-collectors in the beginning of the pipeline.

Different proposals can be considered for enhancing this cost-effectiveness: First of all, from an economic point of view, one should keep the costs of the system low. This can be done by relying on an existing infrastructure of “check points” along the innovation line in the biotech industry, going from the genetic resources and knowledge “out there” to the final product. Existing infrastructure includes databases on geographical origin maintained by collection societies, such as in the case of INBIO or the Smithsonian. Further upon the line, one can consider the system of certificates produced by the customs authorities, the role of patent authorities or the international depositary system within the Budapest treaty. Probably, there will be a choice to be made of the most relevant “check points”. Nevertheless, combining this existing capacity with some standardized rules of the minimal information to be included in a certificate, seems to be the most direct answer to cost effectiveness. Second, on the level of the regulatory framework, the idea of a system for tracing the genetic resources is very general. It is important to keep in mind that, as such, it is clearly not limited to the resources that flow through patent offices, as is often presupposed in the discussions, nor to any other check point of the innovation chain. Nevertheless, if one wants the system to further the objectives of the CBD, it is important to articulate it to the intellectual property regime. The most obvious is of course to articulate it, for the genetic resources considered for commercial use, to a disclosure of origin requirement to be included in patent application. According to the experts and countries promoting such a requirement (Portugal, Belgium, Switzerland and Norway and the EC), a disclosure of origin requirement is compatible with the TRIPS agreement in a system where: Disclosure of origin is only a formal requirement for patent application (and not a substantive criteria for patentability, which determines the eligibility of the invention such as novelty); The disclosure obligation only holds if the origin is known (so no requirement that the patentee has to do further research on the origin); and where the sanctioning mechanisms lies outside the patent system (for example a system of fines for the commercialisation on basis of non certified genetic resources or financial advantages for the certified ones).

## **RE: Trading of genetic material and consequences to biodiversity**

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**Tim Kitchin**, Glasshouse Partnership

Interesting territory. The ability to track physical substances is a key component in developing a market-accountable and regulatorily accountable system for protecting biodiversity. The web services platforms of the big providers: WebSphere, Netweaver etc allow this functionality to be delivered at very low cost and well-integrated into existing vertical applications. These guys should be involved at the earliest opportunity as a key stakeholder in delivery and demand building. However lighter, and more expedient solutions can deliver the functionality you're after...see [www.historicfutures.com](http://www.historicfutures.com).

The deeper issue is the one of adoption in the marketplace. While the power within the system lies with the buyers, the legal framework invites them to avoid compliance. It may be a more effective catalyst for the CDB to work with lynchpin bio-providers and equip them with chain of custody technology. On the basis that what can be known must be known...and that the principle 'what is known must be disclosed' is now legally enshrined, these suppliers could become a powerful driver of the bio-resource-market.

## **Certificates of Origin for Genetic Resources and International Trade Law**

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**Sélim Louafi and Jean-Frédéric Morin**, Institut du développement durable et des relations internationales

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**SUMMARY:** Certificates of origin are considered as one of the most promising “user’s measures” (i.e. measures that genetic-resource users can take to achieve the objective of benefit sharing). But it remains highly speculative to predict how the WTO would deal with a certification scheme on genetic resources.

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Ten years after the signing of the Convention on Biological Diversity (CBD), the objective of fair and equitable sharing of the benefits arising from the utilization of genetic resources - one of the three objectives of this convention- is far from being achieved and continues to stir up discussions. Some provider countries are complaining about bearing most of the costs of regulation while the spin-offs are still at a low level, whether in financial or technology-transfer terms. The diagnosis of this problem differs depending on whether it comes from provider or user countries, from local communities or States, or from researchers or the private sector. It’s true that the issue is not easy to grasp hold of, due to the many different objectives pursued by each stakeholder and to the uncertainty regarding the value of genetic resources.

The objective of the action plan of the World Summit on Sustainable Development to create an “international regime” on access and benefit sharing can be interpreted as a will to find a better effectiveness of the international framework put in place. One of the ideas mentioned as a potential component of the “international regime” is a certificate of origin scheme. It is considered as one of the most promising “user’s measures”; i.e., measures that genetic-resource users can take to achieve the objective of benefit sharing. As a matter of fact, knowing the fact that genetic resources are often transferred and used internationally, it is crucial not to rely exclusively on access legislation of each provider countries. By guaranteeing the traceability along the product development chain, a certificate scheme will allow to establish the missing links between the different stakeholders inside and across borders.

But of course, the state involvement in a certification scheme would bring it under the rules of international trade law. More precisely, a certification scheme adopted to facilitate the implementation of the benefit-sharing objective may be subject to the General Agreement on Tariffs and Trade (GATT) and the Agreement on Technical Barriers to Trade (TBT). However, it is highly speculative to predict how the WTO would deal with a certification scheme on genetic resources. Taking into account the specificities of genetic resources and the rules of the WTO, four concerns must be kept in mind in order to envision a scheme that is both efficient and WTO consistent:

- A certification scheme should be designed on a product basis, not on a country basis or a firm basis.
- A voluntary market-driven scheme of certification for genetic resources is hardly conceivable.
- If certificates attest more than merely the name of the source of genetic resources but also attest compliance with benefit sharing standards, those standards should be established by the providing countries. If a providing country does not establish any standards, genetic resources should be free of any restriction in other countries.
- International coordination on the certification scheme would improve its effectiveness and reduce the risk of a WTO challenge.

Even if all considered safeguards are taken, a challenge under the WTO remains possible. To clarify the compatibility of a certification scheme with the GATT, WTO members could adopt an authoritative interpretation. In fact, this is what WTO members did with the Doha Declaration on Public Health to resolve the controversy over the TRIPS interpretation and access to medicines. A similar decision could be taken, stating for instance that a certification

scheme for genetic resources will be presumed to fall under exception of GATT Article XX(d). But a prerequisite to a WTO authoritative interpretation is a consensus among CBD parties on the certification scheme...

## **Trade and biodiversity question**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Imagine that you are the co-ordinator of a biodiversity project in the theme of this discussion. Your consortium, composed of some excellent teams from all across Europe and from countries outside Europe, includes social and natural scientists and economists. You have received a grant of 10 million. What is the question, or what are the questions, that you and your consortium are trying to answer? Can you phrase it in just a few words: Is there life on Mars? How do marsupials keep their pouches clean? Do cell-phones fry your brains? How much plant life is needed to keep a person alive in a sealed room? Can humanity survive?

## **RE: Trade and biodiversity question**

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**Tim Kitchin**, Glasshouse Partnership

I am trying to discover: "How can trade prevent biodiversity loss?"

## **RE: Trade and biodiversity question**

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**Jeff McNeely**, IUCN

Martin: "How can I find the information about biodiversity that I require to make the decisions I need to make?"

## **RE: Trade and biodiversity question**

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**Jan Jansen**, Radboud University Nijmegen, the Netherlands and ICN-Portugal

Your questions were a good appeal to leave my passive role so far. Without taking time I can give 3 questions for inquiry. I am sure that with a little bit more effort many questions will arise. Questions 1 and 2 are in the multidisciplinary field of economy-biodiversity research-sociology-politics:

1. A conservation strategy on the European level is needed in order to use financial resources more cost-effectively. For instance, billions of euros are now being spent in The Netherlands to restore the quality of the former heathland areas without reaching the biotic and abiotic quality level on a scale that still exists in an area like Serra da Estrela (Jansen & Diemont 2004, subm.). Would not much of the outstanding traditional countryside in marginal area be saved, if only a small part of these funds would be allocated for more cost-effective priority core areas on the European level (Diemont & Jansen 2004, subm.)? One ha of land with high biodiversity in Spain costs much less than one ha of land in The Netherlands with low biodiversity. Where is the efficiency of nature conservation on the EU-level (Van der Straaten 2004)? So as a co-ordinator of the project team that Dr. Martin Sharman described, I would like to work out a practical method in order to spend the money in the best way on the European level.
2. In addition I would study the possibilities of how food prices can reflect the real costs (including pollution costs, restoration of biodiversity, restoration of the cultural landscape, etc.)
3. Another interesting subject is the update of the Habitat Directive. For instance spring communities of soft waters are not included, whereas these are one of the most vulnerable biotopes in the EU-union (Jansen 2002).



## **RE: Trade and biodiversity question**

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**Robert Kenward**, IUCN-European Sustainable Use Specialist Group

To complement (and to an extent overlap) the useful previous questions by Tim Kitchin, Erling Berge and especially Jan Jansen and Jeff McNeely, my questions would be:

1. How best (ecologically and socio-economically) to integrate use of protected areas, creation of connecting ecological networks and yield-reduction offset strategies in the surrounding intensive-use matrix for restoring biodiversity at all levels? (NB yield-loss-reduction offset strategies would include pay-for-use as well as redirected CAP).
2. How to get the most cost-effective restoration of terrestrial biodiversity at local levels, from all available ways of using wild resources? (NB not just from trade and tourism, but in all categories that can be localised or remote, including watching, collecting, fishing, hunting, etc, whether recreational or commercial, and using volunteer efforts as well as direct or indirect payments).
3. What drivers and instruments at higher level can be most cost-effectively changed to facilitate efforts at local level?

## **RE: Trade and Biodiversity question**

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**Tim Kitchin**, Glasshouse Partnership

Dr Jansen makes 3 very interesting points, but I am immediately drawn to the simplicity of his point 2. He asks: “Can food pricing be made accountable for resultant biodiversity loss?”. I am interested in answering the same question, from a slightly different perspective. From a trade vs. biodiversity standpoint, this question presupposes another one: “Should individual consumers be universally exposed to a cost to consume biodiversity?” The consequences of saying ‘Yes’ to such a position from a policy standpoint are profound. The alternative approach is to discover what consumers (whether businesses or individuals) would be willing to pay to preserve biodiversity at a genetic, species and ecosystem level. Both approaches are legitimate components of a mature trade system. But they have radically different consequences in terms of global governance, corporate behaviour and consumer expenditure. Totally different development paths would result.

The ‘cost to consume’ model is ultimately a form of indirect taxation, and is thus directly against the pervasive western free market ideal, if not the more muddled actuality. It seeks to introduce an external cost-stream or an alternative currency into the food value-chain. And would thus face huge resistance from retailers. Nonetheless, this top-down, alternative currency approach has arguably been dominant model to date.

The ‘pay to preserve’ model, meanwhile, seeks to work with the market, presupposing that those who currently consume biodiversity could be persuaded to value both its existence and its quality in their daily decision-making. It seeks to introduce an additional valuestream, adding a meta-purchase of biodiversity into other purchase decisions.

The pay to preserve approach immediately assumes that appropriate information can be obtained, packaged and brought to the point of purchase in compelling ways. The precedents of organic, fair trade, FSC, MSC etc are instructive here as ways of harnessing hidden supply-chain information as product value-add.

Would we need one biodiversity communication system though, or a number of complementary marques? Can the market evolve such a system to protect overall biodiversity or would it inevitably reinforce a bias towards flagship issues – reefs, apes, and forests? Is it possible to envisage a single integrated labelling system? With the advent of web-services and auto-identification technology (RFID etc), the possibility of brand, product, and even item-specific accountability is very real. But how should we harness it? What exactly is the ‘go to market’ model for biodiversity? Etc etc.

The tourism and science/policy debates in this forum are to some extent dependent to this overarching dynamic. Can we control, or should we empower the market for biodiversity? Are we better to continue working top down, or is there a credible case to work bottom-up – to interpret demand for biodiversity, and to actively feed individuals' understanding of biodiversity outcomes, so as to drive changes in market behaviour? Isn't it time to start acting like brand stewards for 'Biodiversity', as well as forensic investigators?

Too little research that I have seen has centred on this bottom-up opportunity. It surely merits an equal share of research attention. Quantitatively and qualitatively profiling the demand-chain is the first step along this path...

### **RE: Trade and Biodiversity question**

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**Juha Seppälä**, University of Turku, Finland

Limiting myself to the topic given in your open question, I feel that the threat of climate change is very real and from a trade perspective I would a) develop scenarios on how climate change will alter present species distributions and their effects on global trade (hey, if we could grow bananas on the mainland, there would be no need for WTO arguments) and b) how the opening up and intensification of trade in the new EU-25 contributes to the spread of alien invasive species, especially via the waterways such as the Danube. This would probably not require 10 M€ though, but I am of course used to dealing with much smaller grants.

## **Initial Trade and Biodiversity Research Priorities**

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**Karin Zaunberger**, Session Chair, European Commission, Management of Natural Resources and Services - Biodiversity Sector, Brussels, Belgium

During the last 2 weeks we have received quite a number of interesting contributions. In this contribution I have tried to retrieve the knowledge gaps and research priorities that have been identified so far.

It is evident that the relationship between trade and biodiversity encompasses various different sectors. These include the connection between trade and invasive species or the issue of sustainable use of resources including the wildlife trade. The transport and tourism sectors are also intrinsically interlinked with the issue of trade and biodiversity.

So far the following research priorities have been identified in the relationship between biodiversity and trade:

- Identify the impacts of trade on resource management taking into account the fact that each specific management problem affecting biodiversity will need to be analysed case by case in order to determine the linkages between the key economic, ecological and institutional drivers;
- Better understand the principles and functioning of biological invasions in order to minimise the risks of non-native species transported unintentionally and unknowingly through trade activities;
- Develop reliable methods to detect living creatures in packing material;
- Understand the effects of selective removal of valuable species;
- Create a system for the traceability of genetic resources (for example barcodes);
- Elaborate strategies to better internalise the costs of biodiversity impacts of trade;
- Elaborate the principle of “consumer’s environmental and social liability”. An example was the inclusion of social costs arising from the cultivation of soybean in its final price;
- Understand how to translate biodiversity events into financial terms in order to allow for effective financial accountability;
- Understand how financial decisions impact on biodiversity;
- Understand the factors which will shape the present and future market for biodiversity outcomes: a) Understand the unique characteristics of a market for biodiversity outcomes; b) Understand the process to grow and sustain such a market;
- Investigate the impact of UNCTAD’s BioTrade initiative;
- Understand the livelihood aspects of harvesting and trading in wildlife products;
- Investigate the role of transportation linked with trade activities and its impact on biodiversity;
- Investigate the specific and broad opportunities for biodiversity markets from knowledge of the properties of biodiversity products that may interest world markets to the best way to forge effective stakeholder partnerships;
- Understand consumer behaviour and market demand for goods and services derived directly or indirectly from biodiversity: How is the demand for biodiversity currently expressed? Who experiences this demand? Which factors will most influence this demand and its visibility? Who can increase and decrease the appetite for biodiversity? Or in marketing terms, how well does the offering of the brand “biodiversity” meet this demand?

## **RE: Initial Trade and Biodiversity Research Priorities**

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**Jan Dick**, Centre for Ecology and Hydrology, Edinburgh, UK

I have just read the researchable ideas posted on this web board. I did not see any mention of the trade in whole ecosystems – rather the focus appears to be only trade of the elements extracted from an ecosystem/landscape. Habitat destruction is recognized as one of the primary causes of biodiversity loss and therefore preservation of the whole habitat is

important. International companies, even on a voluntary basis, have shown interest to invest in the preservation of biodiversity and environmental services from landscapes but a mechanism to initiate international trade is currently lacking (for example <http://www.katoombagroup.org/>). A mechanism is urgently required to protect existing ecosystems/habitats/landscapes both in Europe and globally. A quote on the Critical Ecosystem Partnership Fund web site illustrates my point for a river island in Sierra Leone [http://www.cepf.net/xp/cepf/news/in\\_focus/2003/february\\_feature.xml?USE\\_TEXT\\_ONLY=false](http://www.cepf.net/xp/cepf/news/in_focus/2003/february_feature.xml?USE_TEXT_ONLY=false)). “Tiwai Island is like a ripe banana and we people around this area are very hungry. You are telling us to keep this banana for now and future generations but what would you give us while we are taking care of the banana for you?” The principle of payment for services is equally true in European landscapes. The EU is currently significantly changing land-use policy through the Common Agricultural Policy (CAP) reform without a truly evidence based decision mechanisms in place. The outcome is currently highly unpredictable. The lack of a truly integrated evidence-based mechanism for valuating ecosystems/landscapes in terms of biodiversity supported, environment services provided and potential income generated is currently limiting European, national and local land-use policy-making. It is difficult to make informed decisions regarding land use because social, economic and ecological issues are not valued in a comparable way – policy makers do not have a tool to evaluate all the elements of the ecosystem/landscape – this is a serious researchable problem.



## Biodiversity and Tourism

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## **Introduction to the Biodiversity & Tourism session**

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**Adriana Vella**, Biodiversity & Tourism session Chair, Conservation Research Section, Biology Department, University of Malta, Malta

Tourism is one of the world's fastest growing industries. It is one of the major sources of foreign exchange earning and employment and contributes to socio-economic achievements by constituting an opportunity for economic development, diversification and the growth of related activities.

Tourism can be segmented by the type of destination and by tourist characteristics. Types of special interest travel that are on the increase include: Nature travel, Adventure travel, ecotourism. Given that a high percentage of tourism involves visits to naturally and culturally distinguished sites, generating large amounts of revenue, there are major opportunities for investing in the maintenance and sustainable use of biological resources.

The potential adverse effects of tourism are divided into: Socio-economic impacts (imposed on local & indigenous populations); Environmental impacts; Tourist industry impacts; and Biological impacts.

While various entities including the World Tourism Organisation have already undertaken studies and works to pave the way toward sustainable tourism, many are the challenges still facing humanity in a world where consumerism and profit-making dominate the scene. To counter-balance this, various recommendations and guidelines that have come out from the IUCN (1996); the Council of Europe (1997); the Ecotourism year (2002); the World Summit (2002); the Convention on Biological Diversity – Tourism Development (2003); the V World Park Congress (2003); and more recently the Killarney Recommendations for Biodiversity, have constantly stressed the need for direct and effective biodiversity conservation action, which includes use of accurate and adequate information coming out from well planned research and monitoring.

Therefore in our search for biodiversity research that matters for effective conservation, the aspect of tourism needs to be addressed. Tourism, with its increasing economic role and its increasing focus on diversity and nature, demands greater research and implementation in the areas of cultural and natural diversity.

The far-reaching dimensions of biodiversity to be considered in this conference need to be looked at from the tourism perspective too. The variations in the scales at which biodiversity plays its role in our everyday lives and economies also need to be considered. Our discussions and contributions should span these dimensions and scales in order to come to terms with the different types of research requirements and consequences for biodiversity conservation. Therefore biodiversity and tourism should be considered at: the micro and macro levels; local and global scales; from genes to landscapes; from gastronomic to life-sustaining systems; from environmental managers to community workers and developers; from socio-economic to ecological perspectives; from planning to implementation and monitoring; from the rich to the poor; from country of origin to destination; from policy to effective action.

The integration of various types of research may well be the target of our search, however for this integration to work, the gaps in knowledge and in research that matters needs to be considered as a vital toward understanding how Biodiversity and Tourism inter-relate and influence each other.

Some provocative questions that come to mind are:

- What tourism load and what tourists' behaviours are harmful to various biodiversity, landscapes and vulnerable habitats? Is there a threshold in numbers and/or careless behaviours above which most habitats are in danger? What indicators may be considered to reflect the natural environment's health and the impacts of the tourist? At what levels have research arrived to in order to answer these questions?
- How important is the education and empowerment of local communities and populations toward local monitoring, management and implementation of policy and sustainable

tourism guidelines? Should research in assessing the human knowledge of such policies and determination to implement guidelines and recommendations of any use?

- What research may assist tourism in assessing and addressing the social, economic and environmental status of ongoing activities in a holistic and integrated way?

Over the next three weeks the BioPlatform e-conference will allow a number of valid keynote contributions to pave the way toward discussions within the aim of the conference itself: Biodiversity Research that Matters.

In this tourism session of the conference, each keynote contribution will allow for participants to focus on relevant issues pertaining to the conference from the tourism perspective. We encourage participants to contribute stimulating discussions with their own experience and thoughts.

## **Biodiversity, the scientific basis of tourism**

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**Francesco di Castri, CNRS**

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**SUMMARY:** Biodiversity research is fundamental for the development of a rational tourism. Landscapes and genes - at the two extremes of the hierarchical level of integration of biodiversity elements - are the two units where more research is needed to face tourism issues.

**KEYWORDS:** Landscapes, genetic diversity, research, management plans

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To support the statement of the title, biodiversity should not be considered only at the level of species diversity, but should be defined - in a more comprehensive and holistic way - "as the genes, species, ecosystems and landscapes existing at a given time in a region, and of their hierarchical interactions". On the other hand, tourism refers mostly to the new paradigm of cultural, ecological and adventure tourism, and not the traditional - and somewhere obsolete - patterns of massive beach and mountain tourism.

Within this paradigm, the empowerment of local tourism entrepreneurs - mostly working at a micro-enterprise level - is essential, as well as that of local populations, especially by touching on biodiversity issues. For this, large use is made of the simple tools and approaches provided by the new Information Technologies, including continuous e-learning and Virtual Universities.

It is amazing that tourism, unlike other uses of natural resources such as agriculture, forestry or fishery, largely lacks scientific bases. This is in spite of the fact that tourism represents the most important economic sector of the world, when international exchanges and people occupation are taken into account.

Potential visitors move to tourism in search of specificity and diversity, both natural and cultural. Diversity, therefore, is intrinsic to tourism; it is the main driving force for this economic sector. Furthermore, tourists look after other kind of biological and cultural heritages, and the historical trajectories to reach them.

Out of the hierarchical levels of integration of biodiversity, landscapes (and seascapes) play the most important role for tourism, since they are easily visible and perceivable, and because any kind of degradation or improvement reflects first of all on landscapes. In addition, landscapes - most of them human-made including in very ancient times - represent the crucial and much needed link between biological and cultural evolution, between natural laws and human culture. Landscape is the bridge between natural and cultural heritage, the keystone for a heritage-oriented tourism. Nevertheless, much theoretical and applied research is needed on landscape management, rehabilitation and design, when the specific impacts or - on the contrary - the attractiveness requirements of tourism are considered.

At the other end of the hierarchy of biodiversity, the genes, research is also fundamental when tourism is concerned. Tourists are also in search of culturally-based specific food, derived from ancient and autochthonous plants, animals and traditional cooking. The enormous importance - both economic and cultural - of gastronomic tourism should not be undermined, even when it is not alone (but this is often the case in Europe, especially in France and Italy), but part of a more complex tourism attraction. This implies genetic research for the recovery, almost the resurrection, of almost extinct plant varieties and landraces, including by using biotechnological techniques.

Finally, charismatic animal and plant species can be a tourist attraction per se (in the Galapagos, Aldabra, Sequoia National Park, etc) as well as peculiar ecosystems (tropical rainforests, coral reefs, etc). Specific management plans are required in both cases, based on biodiversity theory, research and practice.



## **What are the main research questions?**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Just what key gaps are there in our knowledge about the relationships between tourism and biodiversity? It seems to me that the kinds of questions we have are:

1. Those related to what motivates people (why do you select this destination rather than that one, what do you like about this place, how much does the diversity of living things add to your enjoyment?);
2. Those related to what impact tourism has on biodiversity (what is the effect on biodiversity of sequestering water for the hotels, how much habitat is destroyed or fragmented to maintain the population of tourists, what is the impact on biodiversity of the consumption of living things due to tourists?), and
3. Those related to sustainability (how can we measure the long-term impact of this activity, how can we draw tourists to this site without altering its biodiversity, how can local people benefit from the tourist euro in such a way as to provide incentives to protect biodiversity?)

Are there any more families of questions to think about? Are most of the important questions in the territory of the social scientist?

How much research has already been done on these issues? I have not been able to find much on any of these things. Is this because I am not looking in the right places, or is there really very little known?

For each of the examples I gave above, the answer will depend greatly on local conditions. Does the research need to be done again and again at every tourist destination? Or can we identify questions for which there may emerge some useful principles?

## **RE: What are the main research questions?**

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**Mauro Agnoletti**, University of Florence, Dipartimento di Scienze e Tecnologie Ambientali Forestali, Florence, Italy

Concerning Tuscany (Italy), where biodiversity is considered not only under the point of view of species diversity, but rather as the diversity of spaces associated to land uses (decreased by almost 60% in the last 200 years) there are already actions undertaken. After the publications of the results of a preliminary project at regional scale, analysing landscape changes in the last 200 years in many study areas (also in protected areas), the Department of Environment decided to produce new guidelines for the management of protected areas with specific indications not only aimed at revising the applications of the habitat directive and the management of the areas, but also promoting tourism. From this point of view specific attention will be given to inform tourists about landscape diversity and the positive role played by man in creating and maintaining this diversity. At the same time, protected areas will have to organise facilities and services needed to host and guide tourists in these areas. Different problems are those related to the policies concerning the territory outside protected areas. Concerning the key role of agriculture and forestry, the issue is how to preserve and restore diversity (intended as above) regulating agriculture, i.e. reducing large monoculture and promoting traditional small-scale productions (although this is not really supported by the EU, see the new reform of European policy in agriculture) and developing new guidelines for woodland management. In this case, an important aspect is the development of agri-tourism, whose main resource is landscape quality. There is the hope that the management of landscape for agri-tourism might be supported by rural development, despite the problems mentioned above about EU policy.

## **RE: What are the main research questions?**

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**Loretto Rossi**, Dept. Charles Darwin –Ecology Area, Rome, Italy

The relationships between tourism and biodiversity pass throughout many aspects of ecology. For examples, decomposition process of organic matter is a fundamental process pumping-out entropy from habitats enhancing ecosystem health. Decomposition of organic matter (remaining constant physical and chemical parameters) is influenced by two principal factors (1) diversity of matter in decomposition and (2) diversity of decomposers. Tourism increases the former factor (the matter diversity importing allochthonous materials), but decreases the 2nd factor (diversity of decomposers, fragmenting and transforming habitat).

So, a question may be: how much different typology of tourism influence decomposition process of autochthonous organic matter decreasing ecosystem health and in turn reducing the attractiveness of those habitats? How does tourism influence the spatial pattern of decomposition efficiency? Can decomposition spatial pattern measurement be used as probe of tourism impact?

## **Biodiversity research: the key to achieving sustainable tourism**

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**John Shores**, Sustainable Development Consultant, San Jose, California, USA

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**SUMMARY:** Biodiversity-friendly tourism risks becoming just another tourism commodity because green-washing and whitewashing efforts in the broader tourism industry blur any distinctions on the supply side. The research challenge is discover how to grow the demand for biodiversity-friendly tourism by designing education and marketing programs to change consumer behaviour and build support for sustainable tourism.

**KEYWORDS:** Travel, certification, monitoring.

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From the islands of the Pacific to the grasslands of Africa to the rain forests of South America to the tundra of the Arctic, these spectacular ecosystems are fascinating places for research on biological diversity. For better or worse, they are also prized travel destinations. Yet these are just the most obvious points of interface between tourism and biodiversity - and therefore certainly excellent candidates for research. Just as important for biodiversity research could be studying the global effects of the tourism industry, often acting on biodiversity in places far removed from any mass tourism and perhaps not regarded as prime destinations for nature-based tourism. It is much more than just lions in the Serengeti or tortoises in the Galapagos.

The Convention on Biological Diversity (CBD) guidelines on sustainable tourism and the Killarney Recommendations for Biodiversity are important steps in guiding and improving the policy and public sector aspects of the tourism industry. But these declarations and guidelines seem to be directed mostly at the supply side. Much more attention and research is needed on the demand side – educating tourists and would-be tourists, and motivating them to create real demand in the travel market for biodiversity-friendly products and services.

We need to assess and monitor the ecological footprint of the complete supply chain of the tourism industry. We need to begin to think outside the destination. Too often in our efforts to green the tourism industry, the central focus is on the destinations: ecolodges, locally grown produce, sustainable energy, trained guides and guidebooks, etc. The 900-pound gorilla in the travel industry is transportation, especially long-haul air travel. Global climate change brought on by green house gases generated by travel and tourism in one part of the globe could have impacts on biodiversity on the other side of the globe. Much of the tourism bubble might disappear if the travel component had to be biodiversity friendly.

One element on the policy side that needs more study is the controversial area of certification programs. We still don't seem to have any convincing evidence, other than anecdotal, that certification makes any difference at the biodiversity level, nor for that matter any evidence that it makes a difference to the tourist in choosing a vacation. If certification doesn't have any real or apparent meaning, it's been reduced to a commodity where the rule of "cheapest is best" may be the traveller's decision.

The tourism-biodiversity research agenda needs to broaden in at least two dimensions. Along the time dimension, we need to identify efficient indicators to monitor in the short term that can predict the status of biodiversity conservation over decades and centuries, and the useful policies and practical actions that can be used to shape those futures. Along the supply chain dimension, we need research that assesses the impacts on biodiversity from the entire spectrum of the travel and tourism industry, not just from the activities at destinations. Achieving a comprehensive view in time and in space will not be easy, but it should supply valuable information and support for the growing movement toward a sustainable tourism in all of its aspects.

## **Sustainable tourism**

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**Eugenio Yunis**, Sustainable Development of Tourism Department, World Tourism Organization

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**SUMMARY:** When planned and managed in a sustainable manner, tourism is one of the few sectors that ally socio-economic development and biodiversity conservation.

**KEYWORDS:** WTO, environmental sustainability, socio-economic factors.

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Tourism has shown a sustained and resilient growth over the last 50 years. According to the World Tourism Organization forecasts, this sector will pursue its growth and, every year, more people will be in motion than ever before.

There is now recognition that uncontrolled growth in tourism aiming at short-term benefits often results in negative impacts, harming the environment and destroying the very basis on which tourism is built and thrives. On the contrary, when tourism is planned, developed and managed using sustainable criteria, its benefits can spread through society and the natural environment.

This fact is now widely recognised and, as a part of this recognition, the interrelations between biodiversity conservation and sustainable development of tourism are reflected in various major documents such as:

- The Plan of implementation of the World Summit on Sustainable Development (2002) that contains a whole article on sustainable tourism (43) and an article on biodiversity (44) referring to “sustainable tourism, as a cross-cutting issue relevant to different ecosystems, sectors and thematic areas”.
- The Québec Declaration on Ecotourism (2002)
- The CBD Guidelines on Biodiversity and Tourism Development (2003)
- The special recommendations of the V World Park Congress (2003): “Tourism as a Vehicle for Conservation and Support of Protected Areas”

Besides these relevant principles and guidelines, many tools and techniques exist that allow tourism developers to increase, among others, environmental sustainability in the sector, among which: Zoning, ecolabels and other certification schemes, environmental indicators, water and waste management in tourist establishments, congestion management at tourism sites, etc.

The World Tourism Organization has conducted studies and published many works aiming at raising awareness among all tourism stakeholders (public and private). WTO activities and publications in this field can be found under the following link:

<http://www.world-tourism.org/sustainable>

The Organization also encourages local authorities, NGOs and universities to conduct research on the actual impacts of tourism activities upon ecosystems, biodiversity, as well as upon local and indigenous cultures and the socio-economic fabric of the tourism destinations. Indeed, it has to be clearly understood that no action aiming at reducing the impacts on the environmental sphere can be dissociated from the two other dimensions of the sustainable development, which are the social and the economic ones.

## **Tourism and biodiversity**

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**David Weaver**, Professor of Tourism & Events Management, School of Recreation, Health, and Tourism, George Mason University, Manassas, USA

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**SUMMARY:** In the early years of the 21st century, tourism continues to display an impressive capacity to colonise and modify all types of environments, including those such as coastlines, coral reefs, karst, small islands and alpine settings that are both biodiverse and fragile. A growing body of empirical research into the economic, environmental and socio-cultural impacts of tourism is available to assist destination managers who desire sustainable outcomes, but sophisticated indicator systems that would reveal whether such results are actually being achieved are not yet in place. These systems require managers to select a relevant critical indicator set, identify appropriate benchmarks and thresholds, and establish an appropriate protocol for measuring, monitoring and evaluating the indicators. They also require sufficient long-term commitments of financial and other resources for their establishment and implementation.

**KEYWORDS:** Tourism impacts, indicator systems, sustainability.

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The biodiversity component of such a system should include indicators that reveal the total area and proportion of 'fragile' and 'highly diverse' biomes that is being impacted by tourism, and the percentage by which such impacted space is increasing from year to year. These should consider the effects of construction, tourist activities and the generation of waste residuals directly related to tourism as separate dimensions, as well as indirect activities such as those associated with the building of houses for tourism workers and the production of food and other goods used for tourist consumption. Research will initially be required to identify the extent of these indirect impacts. Additional tourism-related impacts that should be monitored include changes in the overall number of species, including bellwether, exotic and endemic species, and changes in their populations and distribution. At the other end of the scale, further research is also required to determine tourism's direct and indirect contributions to biodiversity-affecting macro-scale processes such as climate change and ozone depletion.

While the bulk of attention has focused on the negative impacts of tourism, the potential of this sector to enhance biodiversity must also be considered in the indicator set. Special attention should be paid in this regard to the possibilities of ecotourism, within high order protected areas as well as urban and other modified settings. Specifically, to what extent do small-scale and large-scale ecotourism actually provide an incentive to retain relatively undisturbed natural habitat in that state, and to what extent can and do hard and soft ecotourists contribute to habitat preservation and rehabilitation through volunteer activity and donations, both prior to, during and following their visits to ecotourism attractions? What models of ecotourism, accordingly, are best suited to enhanced biodiversity outcomes?

Research prioritisation, in sum, should be placed on (a) the identification of relevant biodiversity indicators that consider the positive and negative, as well as direct and indirect impacts of tourism at the micro- and macro-scale, and (b) the establishment of indicator systems that include appropriate indicator benchmarks and thresholds, and protocols for measuring, monitoring and evaluation. Such systems would reveal the extent to which a particular destination was sustainable with respect to biodiversity outcomes, and would subsequently suggest actions that are required to improve or perpetuate these outcomes.

## **RE: Tourism and biodiversity**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Università di Lecce, Italy

I have read most of the messages. Maybe I am repeating something that has been said already and I did not see. If so, I apologise. Each kind of environment can take up to a certain point of human pressure, then it becomes modified. Tourists are a pressure. Many times also locals are a pressure, especially when they have access to technology that was not available before (see fishermen). We need to find a balance, some sort of carrying capacity of our species in each environmental type. Unfortunately we do not co-evolve with our environment, our technology is going much faster. Even faster than our biological features. And we have to set objectives very clearly. Protecting biodiversity is not enough as a target. What does it mean? Does it mean zero change? But there is always change anyway (it is called evolution). Sometimes we can act as keystone predators, as shown in some Chilean shores. Targets are different from place to place. We need a toolbox of concepts that we can use in managing biodiversity and ourselves. Source and sink theory, for instance, is very important, as is supply side ecology. Do we know how to distinguish source from sink areas? The same place might be source for some species and sink for others. Which one is more important? For the theory of island biogeography, islands are sinks and continents are sources. Protecting islands means to protect sinks. But islands can become centres of speciation, so they are sources of new biodiversity. So, not all islands are the same. But even those which do not have endemics, might be conducive to speciation in the future. What do we prefer in our protection efforts? Species or habitats? Most often we tend to protect species (seals, dolphins, whales, sea turtles, birds) and care less for habitats. It is a terrible mistake. Once we have identified the proper scientific policy to enforce, then we have to see if it is possible to put it into effect from a sociological point of view. Uncrowded places, such as the coast of Oregon or Papua New Guinea are easy to manage. Such situations are almost impossible in Europe. The number of people is overwhelming if related to the amount of available surface. After all, we have chosen to change our terrestrial environments completely, with towns, agriculture and industry, and then we look for “pristine” places in other countries, so to satisfy our biophilia. But our just going there makes these places not pristine anymore. We have to face this: we cannot make an omelette without breaking the eggs. We either start to decrease in number or we will erode the rest of biodiversity, transforming the world in our garbage can. Last week I was in Cairo. The town has 20 million people. Many do not even have a shelter, and live in the cemetery. They want to live like us, and do not care about whales and dolphins. Policies are useless without culture. The respect for biodiversity is not part of our culture. We accept to destroy it in the places where we live (our towns) and we want to have some of it at some convenient place for our vacations. Jan Marcin is very right. People want to know that pristine places are there, but then they want to go to the restaurant. I have spent long periods in Papua New Guinea, on a little island far from everything. Even far from the “facilities” that you might expect in Papua New Guinea. The first week is paradise, after three months it is hell. Biodiversity, there, is amazing (even that of mosquitoes and malarial parasites). Two people I knew were killed by poisonous snakes. These guys do not care about biodiversity, they would like to live like us, as much as us. Also because the oldest persons are 50 years old. And they are exceptionally long-lived. Ecology is the science of interactions, we can be reductionistic for a while (and extract biodiversity issues from human policies issues) but then all things must be put together, simply because they occur on the same planet, and they influence each other. I am sorry to have provided a rambling contribution.

## Yes, but...

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

I agree with your comments 100%, just as I agree with Jan's. But your remarks leave me with a single question: what gaps are there in our knowledge of biodiversity (in which I include humans and human ecology) that must be filled to allow me, and others like me in our millions, to enjoy my holidays in a way that our living world can sustain?

## Yes, but... Where are the gaps in knowledge?

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**Robert Kenward**, Centre for Ecology and Hydrology and IUCN European Sustainable Use Specialist Group

You are encouraging us to find gaps in knowledge of how biodiversity is affected by a number of issues, including tourism/trade/transport/island systems. It may be worth looking also at research questions that run across these issues, and include the other extensive uses that give biodiversity a value, without falling into the categories of tourism and trade. For example, US government surveys estimate individual expenditure in 2001 on hunting and fishing at USD 57 billion, compared with USD 39 billion for wildlife watching (and of the 66 million people who watched wildlife, only 21 million did so by travel of more than 1.6 km from home). Lack of equivalent pan-European data is a pretty big gap, before one even starts to address the question of how to maximise long term value for biodiversity from each activity.

Eugenio Yunis, David Weaver and Lucas Assuncao have already noted the importance of demand for the right sorts of tourism and trade. In terms of impact on biodiversity, management of supply is also crucial. In Kuala Lumpur last February, the Parties to the Convention on Biological Diversity agreed a set of recommendations (Decision VII/12) for sustainable use of biodiversity (the Addis Ababa Principles and Guidelines or AAPG). A major thrust AAPG is for local people to be enfranchised, empowered, enlightened and enabled.

Enfranchisement and empowerment are essential to ensure that agreement on distribution of benefits and costs of development is local, rather than imposed by distant politicians, corporations and other powerful interests. Remote interests may have too little knowledge or concern for local outcomes, or only a short-term interest. So, rephrasing Adriana Vella's question, how adequate in Europe is local empowerment to manage tourism, trade, transport, etc? What perverse incentives (regulatory and fiscal) should be removed and what powers devolved to improve maintenance and restoration of biodiversity?

Enlightenment implies knowledge by local people of what will be the long-term outcome of developments. Without such knowledge distributed locally, the risk is inadequate regulation of developments that destroy biodiversity resources and hence may cost communities more in the long-term than they gain in the short-term. So, how best to collate and deliver existing and new knowledge?

Knowledge will always in some respects be incomplete for local situations; so local people need to be enabled for adaptive management. That brings the need for suitable indicators and rules based on them or, for maximum flexibility, predictive models also fed with local data. To generalize from your three questions of 10 November and start a process of seeking common features across sites one could ask: what are likely to be the best rules, indicators, monitoring techniques and model networks for integrating socio-economic and ecological data in ways that maximise value for biodiversity?

Starting to build systems for local enlightenment and adaptive management could be another way to reveal gaps in knowledge, as well as to reduce the damage to biodiversity from development that repeats mistakes made elsewhere.

**RE: Yes, but...**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

The answer is simple. You are right to enjoy these things, but if there is a million you, then you become a problem. It is always the same story. A nice place is nice as long as there are not too many people. There is a cycle in the exploitation of "nice places". The first step is the discovery. Some guy goes there and says WOW, this is great! The guy goes there for some time and enjoys the place a lot. It happened to me in the sixties, when I discovered the Isola del Giglio in the Tuscan Archipelago. The fishermen were fishermen; there were no hotels, nothing. I went there because a neighbour of my family, in Genova, was from there, and he invited me. Then the place became known for its beauty, and other people start to arrive. The first ones are just like me, but then they are too many, and somebody realises that they can be a source of income. The first pensions are built, and then hotels, and then roads, tourist villages. Now people go there on vacation. I do not put my feet there anymore, since 20 years! It is not the same place anymore. Now there is a different type of people there. Such things still happen in the little islands in Greece. But less and less. Such places are nice as long as just you and I go there. So, there is a dilemma. If we "use" a place for its beauty, we waste it. Of course there is a way. Take Portofino. In that little fishermen village there has been absolute prohibition to build any new building for 40 years. It is for extremely rich people. Everybody can go there, but there is absolutely nothing, and nothing can be done there, besides a couple of extremely expensive restaurants. The mass of tourists can go to other places, along the Ligurian Riviera. In other words, we cannot always have sex with virgins. Just once. Then they are not virgin anymore. The parallel is not proper. Virgins are a bore, whereas virgin places are fantastic. I found virgin (pristine) places in Papua New Guinea. In the Island of Manam, or at Wuvulu, Boisa or in other places that you have never heard of, and that are not even in a standard map. Europe is totally artificial, we know that. If I were the dictator of Europe, I would say that urban development is to be carried out at about 5 km from the shore, and that this 5 km belt is to be kept intact, with just some trails to enjoy it. By walking. Of course, I would leave some trails for handicapped, but I would make it difficult to get almost anywhere. As Jan Marcin said, we do not like to leave our cars. So, we can build artificial amusement places for those who really do not care for nature, and leave natural things for the few that really like them. As it happens at Rimini. Along the Romagna riviera the sea is pure shit. Nobody likes to swim there. People go to the beach to find mates, and to swim in swimming pools. And then they go to night clubs at night. Do we really need to spoil the coast to satisfy this pulse towards nature, since it is simply false? We spoiled the inland with agriculture and industries, let's use the same space for our amusement. You want some more? Here is some more. If you want beauty you have to suffer. Yes, suffer. Suffering means, for instance, to leave your car and walk for two hours, knowing that there will not be a bar at the end of the trail. And knowing that you will have to bring back your garbage, otherwise you will be crucified along the trail (dictators tend to do these things, they like them). People who like nature and want a bar and a garbage can, and a restaurant, would better stay in a nice facility with all these commodities. maybe looking at nature from a safe distance. Let me tell you, dear Martin, that there are not millions of people who really like to walk for an hour to go to a beach and swim in the water. And if a person is ready to do it, it will have a certain form of mind, a certain view of life, and will respect nature. Things are too easy, and if they are easy we give them for granted and do not appreciate them. I speak like a priest! So, let's find the places that have not been spoiled yet, and let's try to preserve them from this usual pattern of touristic exploitation, leaving for them another kind of development. The coast of Salento, where I live, is in some parts like this. The locals want to build facilities right on the coast. It is suicidal. A nice place is a place where there is nothing and there is nobody. This is paradise. For some of us. This kind of people should not be



forced to go to Papua New Guinea to find nice places. And even PNG is not so nice anymore. What about Mars? Again, if you meet people along a trail, far from cars, you say hallo to them. You talk to them. There is complicity. You understand that they are like you. and all this depends on the distance that separates you from the parking lot.

**RE: Yes, but...**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Thank you for your evocative contribution. Once again, it has made me think. And my thinking has led to a (non-rhetorical) question. When we visit wild places, do we really go for the biodiversity?

**RE: Yes, but...**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

No, Martin, we go for the landscape. THEN our expectations are fulfilled if we find a rich biodiversity in it. The landscape, however, is also made of biodiversity (vegetation on land). If we go in a nice place but find no animals at all, then we are disappointed. In Italy, for instance, there are still lots of nice landscapes, but seeing wild animals is so rare. You go to the United States and you have to kick deer, vultures, raccoons, weasels, seals, eagles, you name it. the landscape is nice and there is a perception of a rich biodiversity, at least in terms of large animals. Of course such biodiversity is sustained by the rest of biodiversity. If we find butterflies we are happy- and humming birds. People go to Africa to see biodiversity. The landscape is rather boring. So there is a mixture of different expectations. If you see a coral reef, you are fascinated by the biodiversity of corals and fish, no question about it. They are biodiversity and they are the landscape.

Well, I know I have the ready made answers to all your questions. You know, I once reviewed a research proposal of a good friend of mine (also a very good ecologist). The guy said in his proposal: we institute national parks often with no scientific background. I want to provide a conceptual tool to say if a place is good for a park. If it is a good park it has to work properly, so there has to be good ecosystem functioning. How can we measure this? Simple, by measuring the efficiency of the two main processes that sustain ecosystems, primary production or decomposition. My friend is a world expert on decomposition, so he chose decomposition. In my review of the project I could not resist saying that such a proposal equals conferring the title of Miss Universe (or Mister Universe, I want to be politically correct) based on the analysis of urines. Of course both Miss and Mister Universe should have beautiful urines, but this is not enough. Otherwise a sewage treatment plant would be a wonderful national park. We chose natural parks based on beauty. Is there a scientific way to define beauty? Of course there is aesthetics, but it is more an artistic and philosophical discipline, and it often relates to the human representation of beauty, art.

So I wrote a book on beauty, entitled the ecology of beauty. Now it is in the hands of a publisher who will eventually publish it. I hope. By now it is in Italian. That's why I have all this answers, I thought for months about this thing, and wrote 200 pages on this, with hundreds of pictures.

The uncultured spectator goes for the beauty of the landscape, the cultured spectator goes for biodiversity too. You can appreciate a beautiful painting for many reasons. The first one is that it satisfies your senses. But one can go further in appreciating beauty, arriving also at biodiversity while passing through landscapes. My friend Frank Zappa, when he was a boy, once went to his music teacher and asked him WHY he liked the blues so much. The teacher

explained him the “secret” note progression of blues, and the way it impacts on our way of listening. Some people like it, some people do not. Frank liked the landscape of blues music simply because it produced a positive reaction, then he learnt why he was liking it, going into its structure. There are many levels of appreciation of the same thing. Beauty is what we are looking for. All the time. Because we want to satisfy our senses, in order to have beautiful (full of beauty) impressions. It is very simple. Simplicity is beautiful. And very difficult to achieve. Biodiversity is the sublimation of simplicity (the stupid elements of DNA) via the expression of a baroque array of variations on a simple theme. Just like the blues. Just like throwing some colours on a piece of cloth, or on a wall. The next question might be, is there absolute beauty? My answer is yes, but do you want me to re-write my book in the forum? Then nobody will buy it!

## **Now I've got it- the beauty counts!**

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**Jan Marcin Weslawski**, Institute of Oceanology PAS, Poland

Thanks Fernando for the issue of beauty - and I do hope your book will appear soon in English!

My feeling was always that biologists are shy of speaking about the aesthetic values of nature. To protect biodiversity we used to call economic value of goods and services, value of unknown medicinal plants, importance of functional biodiversity etc. That gave us a feeling of "firm arguments" easy to understand by politicians and economists. But finally, from the tourist point of view, it's the beauty that counts, and it can certainly be valued. The art merchants have no reservations about putting the price tag on a painting people will come to see. He is not arguing that this painting is good in covering the hole on the wall or may be used as an umbrella. He is using our need for aesthetics.

What we have in our responsibility are the nature art galleries. And as you need a proper ventilation, light and walls in a gallery, we need a habitat. There are more analogies - some kind of art is very important - but many people don't like it (majority would go for an easy art - say impressionists). Just like with tourists and biodiversity- the choice is not after the importance or biodiversity richness, but after the sheer beauty of an animal and its display.

So the aesthetics of biodiversity shall be quantified - again sociologists are needed.

## **RE: Now I've got it- the beauty counts!**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Università di Lecce, Italy

Yes, Jan Marcin, and this is why people like to watch documentaries on living things on TV, because they are beautiful. A park, a protected area, is characterised by beauty. We are shy to say these things, because we cannot quantify beauty, there is not the equation of beauty, or the budget of beauty. But all our decisions are based on this. We choose our mates on this, our house, our car, everything. Beauty makes the world run. The rest is infrastructure, it is needed and it is much appreciated when it is not there, but we really do not care much about it. Some of the perception of beauty is quantified when we speak about charismatic organisms or habitats. But then all natural things, at the end, come out to be beautiful. One of our main damages is to destroy beauty from our landscapes, with ugly buildings, for instance. Architects are responsible of much ugliness simply because they do not give proper value to biodiversity, they do not know how to read its beauty, and their paradigms are different from ours. We need to mediate all this. I think that we need some sort of revolution in our approach to biodiversity issues, leaving of course the mechanistic side of our research, it is very important and must be pursued, but we need also to explore other things. Things that, paradoxically, make our expertise very important to the public (and, thus, to politicians) and that we consider as futile. I am annoyed to see lions on TV all the time, and that nature is depicted just with these obviously beautiful organisms. There are so many other beautiful things out there. People should learn to appreciate them. It is a luxury, I know. Anyway, again in Papua New Guinea, I was stuck by the beauty that these guys were pursuing. Their tribal art is fantastic, and the way they produce their simple tools requires beauty, is aimed at obtaining beauty and they appreciate the beauty of their environment. OK, I will share some of my rambling thoughts with you. Take the Zen garden of the 13 stones. It is built so that, from any point of the perimeter of the garden, you cannot see all the 13 stones at once. From every point there is a stone that hides some other stone. The more you know about a stone the more this knowledge prevents you to know about other stones (simply because the stone you are looking at is hiding some other stone). This garden is the principle of indetermination of Heisenberg: the more you know about the velocity of a particle the less you know about its position, and the more you know about the position the less you know about the velocity. It has very deep implications in the way we perform our science. You can convey a message

with a set of formulae or... with a garden. Of course I am not saying that formulas are useless. They are extremely useful, but most of us survive without using them, we are happy to use the outcome of these formulas, handled by somebody else. Just like we eat meat but we are not butchers. The beauty of the concepts, however, must be part of our culture. And the garden is very appropriate. Then one might even be attracted by the mathematical notation - or not. Who cares? I study jellyfish and I go deep into this topic, but everybody is able to see the beauty of the jellies, and I am not offended if people do not know about them as much as I know. I am very reluctant in saying these things, usually, because scientists do not respect this way of thinking so much. But maybe this is why there is not so much understanding towards us by politicians and the public. Thanks for understanding, Jan Marcin.

## **More on biodiversity and Tourism**

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**Jan Marcin Weslawski**, Institute of Oceanology PAS, Poland

It was good to come back to the basic question: “what are the gaps in our biodiversity knowledge, that must be filled to allow its sustainable use (tourism in this case)?” (Martin). It is also good to ask “what we are going to preserve the biodiversity for?” (Fernando). From the tourist’s point of view, only a clearly visible fraction of biodiversity counts - charismatic species and landscapes that you may see (nobody is travelling far to enjoy the beauty of Shannon Wiener index of biodiversity). From the conservationist’s point of view the habitats are key issues -and the more of them you protect the better. From the ecologist’s point of view the functional biodiversity is most important, that may mean the fascination with the variety of microbial biochemical adaptations in stinking, deep anoxic zone of the Black Sea. Here the seal counts for nothing, and the most important part of biodiversity is the invisible one. From the local user’s point of view - only that part of biodiversity counts that directly supports personal needs. As to the gaps in our knowledge - we need more sociological studies - but more of the EO Wilson, science oriented type, about the relations of developed populations and the nature/biodiversity. E.g. - wealthy tourists are enjoying the jungle from the comfort of a limousine, not getting into direct contact with it, but will buy the wildlife products from the locals (mounted spiders etc) that some people will collect for them. In effect they need both the facilities (roads, cars, services) to enjoy the safe distance, and they exploit indirectly the resources, most often in the very devastating way. Can we have the same economic benefit from artificially created “wildlife trips” that would save the real wildlife? A lot depends on where the clients are directed to by tour operators, and what is the story to tell. People will go to less fragile and less diverse habitats if wisely guided.

## **RE: More on biodiversity and Tourism**

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**Mauro Agnoletti**, Università di Firenze, Dipartimento di Scienze e Tecnologie Ambientali Forestali, Florence, Italy

The matter of habitats reported by Jan Marcin Weslawski suggests an example from the Tuscan experience, quite paradigmatic for the way biodiversity conservation is understood and applied in Italy. In a research regarding the application of the EU habitat directive and landscape diversity in some protected areas of Tuscany, we noted that chestnut groves were not considered in the list of habitats to be protected, while a habitat called “mixed woods with chestnuts” was listed. As everybody knows, chestnut groves, especially those still existing in many parts of Italy, often several centuries old, are perhaps one of the most important elements of our forest landscape. Moreover, several investigations showed that species diversity in managed chestnut grove is sometimes higher than in abandoned ones. Nevertheless, chestnut groves were not included in the list because they were considered to be artificial forests, consequently the management plans of several protected areas prescribed to turn all chestnut groves into mixed forests. In this way we are completely losing a “habitat” not less valuable than others included in the list, from an ecological point of view, and a much more valuable element from the landscape point of view.

A habitat is already very difficult to preserve because it needs the work of the man, but now it is also threatened by the application of a law. On the other hand we are instead preserving a mixed forest, which is only a temporary stage of the evolution from a pure stand of chestnut to a future stand with a structure close to the potential vegetation of the area. The results of this policy, together with the abandonment of rural and forestry practices, is the growing extension of a mixed forest layer covering abandoned fields, pastures or originated from former managed forests. According to present monitoring activities this trend seems very satisfactory for biodiversity conservation, although diversity at landscape level has been dramatically reduced. Perhaps somebody knows if this is just the case of Tuscany or a common EU trend.

## **Livestock or citizens: the Balearic experience**

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**Cristian R. Altaba**, Laboratory of Human Systematics, University of the Balearic Islands, and Department of the Environment, Government of the Balearic Islands

Herewith my thoughts and experiences on the initial questions posed by Dr. Vella:

1) There are very few credible assessments of the tourist load a natural area can withstand. In general, there are no data. And when existing, all too often the figures have been derived from asking the visitors about how they feel --i.e., too crowded, how satisfied, enough services, an so on. Nature is seldom asked.

2) The ultimate way to ensure sustainable tourism is to provide local populations with accurate knowledge about what are those tourists seeking. I would say that environmental education should aim at showing that we must choose between being passive objects of a history to be found in textbooks, or being active subjects in the building of the place we live in.

3) This translates for the touristic industry as a dilemma between viewing tourists as a valuable livestock, or as fellow human beings with their own values. Ideally, these values should match those inspiring a sustainable activity. Thus, we need much research focusing on both the local population and its relationship with the environment, and on the perceptions, attitudes and behaviours of tourists.

Some additional ideas on how these issues have been developing during the last century in the Balearic islands can be found at: <http://www.ukotcf.org/pdf/calpe/calpe125-144.pdf>

Of course, I speak at my own risk, without implying any official position of my employer!

## **More natural science in socio-economy of tourism**

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**Jan Marcin Weslawski**, Institute of Oceanology PAS, Poland

I agree, that present knowledge on tourism pressure on the biodiversity is difficult to use.

One of the facts is the methodology of social sciences - questionnaires etc that a tourist fills. Based on my experience from the coastal ecology in Baltic, there is a great gap between the public perception, declarations, expressed will etc, and the actual activity.

The way out of it, is to treat tourist as any other object of natural science, observe, not talk to. What we found, is that: some 80% of the people filling the questionnaires about their ideal mode of recreation on the sandy shore answered “...long, undisturbed coastline, with birds and waves only, no other people except me and my partner”.

We went to the field with binoculars and counted how far people were walking away from the entrances to the beach. And, 90% of tourists stay within 200m distance from the parking lot, having at best a long look at the “wild beach”, but never actually going there.

I think that most tourists look for a “not so close encounter with nature” supplied with attractive information, and personal feeling that unspoiled nature is in their reach. So, the main problem is simply the number of people who would like to enjoy the nature. Problems start when tour operators and managers cut the nature area with numerous easy-access entrances, roads, facilities etc. If you will organise a cable train to Mount Everest, you will have thousands of visitors daily, without it, most of us are happy to have a safe look from a distance. From the sociological point of view, the absence of permits, tickets, restrictions etc is important. Nobody likes it, and you may have the same effect (uncrowded protected areas), just by not filling a nature area with so many facilities. Instead, well-organised, attractive visitors centres, and localised activities will absorb the great majority of tourists.

## **Involving GIS in integral conservation of natural values of Tara NP (Serbia and Montenegro)**

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**Dejan Radovic<sup>1</sup> and Ivica Radovic<sup>1</sup>**, Institute of Zoology, Faculty of Biology, University of Belgrade

**SUMMARY:** The main subject of this research is implementation of Geographical Information System (GIS) technologies in comprehensive valorisation and protection of natural potentials and values of Tara NP, Serbia and Montenegro (180 km Southwest from Belgrade). The mountain complex of Mt. Tara is one of the most important centres of Balkan and European ecosystem and species biodiversity.

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Tara National Park (19,175 ha) encompasses the largest part of the Tara Mountain in west Serbia 180 km from Belgrade, with an average altitude of 1000–1200 m. The highest point of Tara NP is Kozji rid (1,591 m), and the lowest point is at 300m. Within Tara NP, we can differentiate two characteristic spatially-functional areas: High Tara (11,562 ha) and Flat Tara (7,613 ha). The national park is completely within the territory of the Bajina Basta community.

Tara National Park was established in 1981 and is a:

- Biogeographical region
- Mixed mountain and highland ecological systems
- Nominated localities (Serbia and Montenegro Commission for UNESCO) for MAB Biosphere Reserves and
- Possible trans-boundary cooperation and establishing of TBR with Bosnia and Herzegovina

Protected natural areas management:

The Law on National Parks founded the public services for the management of national parks in 1993. Today the Public Enterprise “Tara National Park” has about 270 employees.

Flora and vegetation of Tara Mountain:

The mountain complex of Tara Mt. is characterized with specific geomorphologic, hydrologic, geologic, soil and climatic features. This abiotic diversity is accompanied with a high level of biodiversity. Tara Mountain is one of the most important centres of Balkan and European ecosystem and species biodiversity. It is one of the most wooded mountains. Wood complex belongs to most preserved, the highest quality and the most productive wood ecosystem in Europe.

To this contributes the existence of diversified and well-maintained communities of old deciduous and mixed coniferous forests (beech/fir/spruce), which present a unique example of well-developed and preserved forests in SE Europe with numerous endemic and relict species of indigenous flora and fauna. By now 1013 plant species have been recognized in Tara Mountain, representing almost 1/3 of all flora of Serbia. One of them is *Picea omorika*, the living fossil of European dendroflora. Over 35 different communities exist in Tara; deciduous forests mixed (deciduous-coniferous) forests and coniferous forests and 19 meadow communities.

Important species of flora:

1. Paleoendemic species: *Picea omorika*, *Centaurea derventana*, *Potentilla visianii*, *Aquilegia grata*, *Edraianthus graminifolius* aggr., *Gypsophila sperguliifolia*, *Onosma stellulatum*, *Halacsya sendtneri*, *Cephalaria pastricensis*, *Haplophyllum boissierianum*, *Daphne blagayana*, *Hieracium waldsteinii*, *Acer heldreichii*.
2. Endemic and subendemic species: *Euphorbia subhastata*, *E. glabriflora*, *Satureja subspicata*, *Cerastium decalvans*, *Moehringia bavarica*, *Stachys anisochila*, *S. scardica*, *St. chrysophaea*, *Thymus jankae*, *Gentiana dinarica*, *Pseudofumaria alba*, *Potentilla mollis*, *P. malyana*, *Silene monachorum*, *Pedicularis heterodonta*, *Dianthus petraeus*, *D. sylvestris*



*papillosus*, *Genista friwaldskyana*, *Linaria rubioides*, *Arabis procurrens*, *Verbascum bosnense*, *Lathyrus binnatus* itd.

3. Widely spread relict species: *Cheilanthes marantae*, *Taxus baccata*, *Ilex aquifolium*, *Juglans regia*, *Ostrya carpinifolia*, *Staphyllea pinnata*, *Daphne laureola*, *Ruscus hypoglossum*, *R. aculeatus*, *Erica herbacea*, *Spirea cana*, *Waldstenia ternata* (+), *Asarum europaeum*, *Cardamine waldsteinii*, *Paeonia officinalis*, *P. corallina*, *Saxifraga marginata*, *Lonicera alpigena*.

4. Boreal relicts on the south border of their diffusion: *Goodyera repens*, *Corallorhiza trifida* i *Listera cordata* Fauna of Tara.

The following have been recorded in Tara:

- 115 species of daily butterflies
- 27 species of fish
- 12 species of amphibians
- 12 species of reptiles
- About 170 species of birds and
- 51 species of mammals

Special value to the fauna of Tara gives presents of *Pyrgomorphella serbica* an endemorelict from Pliocene.

The goals of Tara NP GIS:

The basic goal and mission of this project is to apply GIS technology in universal estimating and valorisation of natural potentials/characteristics in Tara NP. First of all to enable their efficient and long lasting protection along with sustainable development. We tried to implement modern scientific knowledge in biodiversity protection, conservation ecology and geography in management mechanism of national natural resources. GIS of Tara NP should enable further development of fundamental and applied research projects and realization of concrete subjects regarding managing natural, socio-economic and anthropogenic potentials of this National park.

This type of evaluating and protecting opens the possibilities to implement the concept of sustainable use of resources in Tara NP. Data model for GIS Tara NP was defined to support the needs of Tara NP and represents the result of system analyses and scientific research in the field of GIS. As a typical example of data models in GIS, this data model can serve as a base to realize others spatially oriented informational systems. The themes created for GIS of National Park Tara are:

DEM, resolution 20 m. DEM is within coordinates: XYmin=19o14'30"; 43o49' and XYmax=19o41'30"; 44o01'; Geological cover; Soil cover; Hydrology; Vegetation communities; Border of Tara National Park (19,175 ha); Locations of interesting endemic and relict species of flora and fauna; aerial photo joined to DEM; Roads; Settlements; Tourist contents, and Five totalities of Tara NP (divided into 751 parcels and sub parcels). For each parcel 9 information points are related in the database (8 tables and 2978 syllables):

- Name of the totality,
- Number of parcel,
- Number of sub parcel,
- Type of woodland,
- Vegetation communities that occurs,
- Ecological belonging of vegetation to the type of pedology,
- Percentage of every vegetation species that occurs,
- Purpose that is used for, and
- Level of protection

In the future this GIS will provide the Park managers and scientists (natural, technical and social sciences) with a valuable database for managerial and scientific applications.

## **Rural tourism: another chance for environment protection and biodiversity preservation in agro-ecosystems**

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**Cristian Kleps** , Romanian Academy of Agricultural and Forestry Sciences, Romania

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**SUMMARY:** Agriculture represents the basic branch of the Romanian economy and holds 18.5% of the internal gross income and about 35% of the work force involved in this sector. The economic and social changes after 1989 are reflected in agriculture through the change of property forms, the new types of agricultural exploitation and the development of market economy relationships. In the middle of this change stands the agricultural producer who faces different types of pressure generated by economical factors (financial resources), social factors (local community, family), physical factors (land resources, climate conditions) and by infrastructure (credit accounts, marketing, material supply, professional experience). Therefore he is forced, more and more, to assume the responsibility concerning the viability of his work, by taking the right decision. In this frame, rural tourism may be a valuable option for additional financial resources, with an obvious benefit for environmental protection and biodiversity preservation.

**KEYWORDS:** Rural tourism, agro-tourism, sustainable tourism

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Together with its natural resources, Romanian rural space also benefits from an ethnographic and folkloric potential of great originality and authenticity. This spiritual dowry, represented by popular architectural values, popular techniques and appliance, traditional crafts, folklore and ancestral customs, popular festivals etc, is supplemented by numerous artistic and historic monuments, archaeological vestiges and museums, which amplify the inestimable historic-cultural thesaurus of the Romanian village.

Rural tourism with its component, agro-tourism, has been empirically practiced in Romania for over 60 years. After 1990, this tourism developed more amply and even organised itself on external and internal markets. Rural tourism and agro-tourism, as economic and social-cultural activities, frame to the protection standards for a natural and humanized environment, namely a tourism based on ecological principles. Consequently, we consider that these two forms of tourism frame to the area of a sustainable tourism.

The humanised and natural environment represents “support” and “raw material” for a sustainable development of any economy. There is a complex relationship between rural tourism and the surrounding environment, the connections between them manifest in both directions. Natural environment and the historical, cultural dowry of villages by their components: water, air, flora, fauna, relief, landscape, historic monuments and ethno-folkloric traditions etc represent the main resources of tourism; on the other hand, tourism in its complexity influences the cultural and ecologic environment, modifying the components mentioned above. Consequently, the development of tourism represents a necessity in paying a special attention for the surrounding environment by protection measures and development of its quality and resources in the areas included into the tourism in the prospects to be taken account of by tourism as well as the control of the consequences of this activity for the optimum evaluation of tourism potential.

Starting with the concept that “the sustainable viable development and also supported from the ecologic point of view is considered to be the development that satisfy the needs of the present age without compromising the capacity of future generations to satisfy their own needs”, rural tourism, as an economic activity represents this scientific issue and should collaborate with other industries and economic activities in order to ensure the quality of environment and to preserve the biodiversity.

## **Biodiversity: Carrying capacity and management**

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**Desmond Kaplan**, Architects and Sustainable Development Planning Consultants, Yodfat, Israel

Whether it is termed eco-tourism, agro-eco-tourism or some related name, tourism clearly provides a significant means for making biodiversity products worth more through preservation and enhancement rather than exploitation for short-term gain. At present, it would appear that this still exists more as potential than reality; the challenge is in finding ways to make it happen. The oft-quoted example in eco-tourism is the converting of the poacher to a game warden where his income is guaranteed from a positive rather than a negative contribution to biodiversity preservation and enhancement.

As planners of tourism regions and destinations, one of the central questions constantly confronting our practice relates to the definition of the carrying capacity of any given location and the kinds of controls that need to be put in place to ensure sustainability of the development or project and its surroundings. I am not familiar with any comprehensive material that deals with tried and tested techniques for effectively measuring the impact, positive or negative of tourism on biodiversity at a project level, integrated with an environmental management program. There is no shortage of definitions of the need to do this kind of thing but little to show how it is done.

There is clearly a relationship between the carrying capacity of a given area and the type of environmental management being practiced there. For example, a trail that is regularly patrolled and maintained will be able to carry more visitors without significant environmental degradation than one that is not; the difference between the two situations could possibly be measured in hundreds of percentage points.

In plans in which I have been involved, we have defined the requirement to carry out environmental management according to given sets of criteria but have not been able to back it up with comprehensive examples of successful practice. This must surely be a major focus for applied research. It certainly affects planning and implementation decision-making.

## **Ecotourism and ecolodge development around the world in the 21st century**

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**Hector Ceballos-Lascurain**, Director General of the Program of International Consultancy on Ecotourism (PICE) and Special Advisor on Ecotourism to IUCN (The World Conservation Union) and the World Tourism Organization (WTO).

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**SUMMARY:** At the beginning of the millennium, ecotourism is not merely a buzzword, but rather a global phenomenon that is starting to provide tangible benefits for many developed and developing countries. Ecotourism has become one of the fastest growing segments of tourism activities around the world and has proven to be a valuable tool for conserving biodiversity and promoting sustainable development.

**KEYWORDS:** Planning, ecotourism, ecolodge.

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Tourism is the world's most important civil industry, annually representing a US\$ 3.5 trillion activity. International tourist arrivals totalled 694 million in 2003 (WTO, 2004). The segment of tourism undergoing the fastest growth is nature-based tourism, which includes ecotourism (WTTC, 2000).

Clearly, tourism has a paramount economic role for countries around the world and, if planned and managed correctly, can significantly contribute to sustainable socio-economic development and environmental conservation. If uncontrolled mass tourism is allowed to continue overrunning many areas of natural and cultural significance, irreversible damage will occur in these areas, which are the repositories of biological and cultural diversity in the planet as well as important sources of income and well being for all countries and many local communities. Consequently, the appropriate interaction between biodiversity conservation planning and tourism planning and development has become a key concern for many institutions at the local, national and international levels.

Sustainable tourism, especially ecotourism, has the capability of being a feasible tool for biodiversity conservation by providing economic alternatives for communities to engage in other than destructive livelihood activities, creating new revenue streams to support conservation through user fee systems and other mechanisms, and building constituencies that support conservation priorities by exposing tourists, communities, and governments to the value of protecting unique natural ecosystems.

Ecotourism, as defined by IUCN - The World Conservation Union -, is "environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy, study and appreciate nature (and any accompanying cultural features - both past and present), that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local populations" (Ceballos-Lascurain, 1996).

Since the late 1980s ecotourism activities have increased remarkably. Governments of the most varied countries are showing heretofore-unknown interest in ecotourism, recognizing its enormous capabilities for conserving the natural and cultural heritage of their nations and also its rich potential for ensuring sustainable development. NGOs around the planet are also embarking upon ecotourism projects, recognizing in them an important ally. Ecotourism operators and professional membership organizations are sprouting everywhere. Local communities in remote localities, which until very recently had very little contact with "modern" civilization, are now attracting ecotourists to their settlements in the jungle, the desert or the island

A product of the ecotourism industry is packaged lodge accommodation in remote, natural areas. According to The International Ecotourism Society (TIES), "the term ecolodge is an industry label used to identify a nature-dependent tourist lodge that meets the philosophy of ecotourism" (Hawkins et al., 1995). It must be stressed that "the most important thing about an ecolodge is that the ecolodge is not the most important thing" (Ceballos-Lascurain, 1997), i.e., it is the quality of the surrounding environment that most counts: the nearby

natural and cultural attractions - and the way ecotourism circuits are set up, operated and marketed, also the way in which local populations are actively involved in the process.

The main reason for a tourist coming to an ecolodge is that it provides the opportunity of being in close contact with nature (in some cases, supplemented by interesting cultural elements).

In any ecolodge project there is the need to apply a new approach to architecture, now widely termed as ecological design or “ecodesign”. Ecodesign may be defined as “any form of design that, being integrated to the surrounding ecosystem, minimizes its negative environmental impacts” (Ceballos-Lascurain, 1997). Ecodesign is an integrative and ecologically responsible design discipline. It consists of joining isolated efforts in what has been loosely termed as “green architecture”, sustainable agriculture, ecological engineering and many other fields, sometimes widely dispersed, in which we must include ecotourism.

Ecolodge development, being a consequence of ecotourism, is a new phenomenon and lessons are being learned every day around the world in this fascinating and fast-growing field. There are several areas where ecolodge development is being successfully implemented. Some key areas of ecolodge development around the world include Costa Rica, Belize, Ecuador, Peru, Brazil (mainly the Amazonian area), Venezuela, Australia, New Zealand, Malaysia, Kenya, Tanzania, South Africa, Malawi, and Botswana.

Hopefully, in the not too distant future, all ecotourism activities and facilities will be generally carried out in a more environmentally-friendly way, which will contribute to the conservation of our planet’s natural and cultural heritage, including the valuable resources contained in national parks and other protected areas around the world.

Conclusion: Tourism and environmental ministries of all countries around the world should be encouraged to promote ecotourism plans and programmes as a high priority government policy, including the design, construction and operation of appropriate ecolodges in and near protected areas. Rich countries should also provide more economic assistance and technical orientation in these fields to less developed countries. There is still an important gap in ecolodge design research and development around the world.

## **Tourism and Biodiversity - A Key Role for Environmental Management**

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**Desmond Kaplan**, Architects and Sustainable Development Planning Consultants, Yodfat, Israel

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**SUMMARY:** An integrated approach that includes cycles of research, planning, implementation and adjustment is required in order to effectively come to terms with the dynamics and complexities of constantly changing realities on the ground.

**KEYWORDS:** Environmental management, planning, ecotourism.

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As a planner I am constantly faced with the question of the relationship between a plan that has been produced at a given time, based on an understanding of the situation at that point, and the process of implementation over an extended period, especially when dealing with a timetable for implementation that may span many years, if not generations. During the implementation period, more often than not, changes take place in the field that require a response from the plan. Alternatively, new information comes to light that obliges one to make adjustments.

As an example, I would like to refer a regional plan that we prepared for part of the Upper Galilee in Israel. The goals of the plan include:

- Creation of conditions for the strengthening and development of the northern section of a north-south ecological corridor (with appropriate biodiversity) that more or less accompanies the course of the Jordan River.
- Preservation of the rights and livelihoods of the rural communities in the planning area.
- Development of tourism as a vehicle for sustainable economic development of the area.

The plan essentially subscribes to the triple bottom line concept that is the basis of ecotourism (community development, economic feasibility and environmental responsibility) while providing a framework for adapting to change. It does this through the provision of three basic components:

- An overall guide plan that essentially lays out the framework for development, both physical and policy-wise. This document is intended to be reviewed and adapted periodically.
- An environmental zoning map that defines development potentials, limitations and restrictions, including geophysical and ecological parameters.
- An environmental management framework. This is probably the most important part of the plan since it creates the vehicle for ongoing monitoring of the plan's implementation and adaptation, as required.

Research work is required to further develop and extend the tools available to those carrying out the environmental management work so as to ensure that they are equipped with the best means available to achieve optimum results and feed a positive ongoing development cycle.

These tools cannot be limited to scientific/laboratory measuring devices but need to include organizational and resource management skills and techniques that can integrate the contributions of the various organizations, interest groups and stake holders in the region; these include government ministries, regional and local government bodies, NGOs, professional organizations, independent lobby groups (such as business organizations) and local residents. To this end the plan proposes the establishment of an environmental management forum made up of representatives of the above to oversee the implementation process. This provides a vital operative platform, the workings and performance of which should also be monitored and studied, the subject of applied research that serves an ongoing learning cycle. This process needs to include identification and mobilization of appropriate resources to achieve the desired results.

## **Tourists' perception of coastal values**

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**Marcin-Filip Jedrzejczak**, Institute of Oceanology, Polish Academy of Sciences, Warsaw, Poland

I have never posted any message on the electronic conferences, because as a young researcher I am trying to see the point of view of my older and more experienced colleagues.

To have some small contribution to the discussion about tourism and biodiversity, especially to messages posted by Jan Marcin and Ferdinando, I would like to present my newest paper that consider aspects of what is beautiful or ugly for people, what is of great importance for people frequenting a beach, and what is not important, what people like or dislike the most. You can simply download this paper from <http://www.eucc-d.de/baltcoast2004/papers/Jedrzejczak.pdf>.

This preliminary study covers investigations from Polish beaches in 2003. This is also a small focus on people's perception of beach animals. I guess that this paper might be interesting for you. I am not a sociologist; I am marine ecologist, so there is a need to involve sociologists in such investigations. I completely agree with Jan Marcin within this topic. Actually, I am just wondering about presenting this paper at a sociological conference that might be of vivid interest for sociologists.

## Tourism as a tool and a threat

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**Ralf Buckley**, International Centre for Ecotourism Research, Griffith University, Australia.

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**SUMMARY:** The Message from Malahide and the Killarney Declaration say rather little about tourism, except that it should be “sustainable.” But in fact, tourism may be of enormous significance to biodiversity conservation, both as a tool and as a threat.

**KEYWORDS:** Ecotourism, protected areas, tourism impacts, North-South.

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At the most basic level, humans need to conserve other species because they keep the planet habitable for humans. We don't know exactly how planetary ecosystems work, but we do know we are dependent on other species and they are dependent on each other.

But currently, human societies are very poor at conserving biodiversity – species are still becoming extinct, habitats are still being destroyed or degraded. So human societies need better tools for biodiversity conservation. These are not just technical tools, such as setting up protected areas and managing them to control exotic species, pathogens and pollution, difficult enough though these tasks may be. More crucial are social tools, ways to get people to undertake those technical tasks. Tourism may be one such tool. Increasingly, it is used as a political justification to establish parks, and an economic mechanism to fund them. This is especially important in developing nations. If ecotourism can alleviate poverty, it can maintain parks that conserve biodiversity. There are indeed examples where this does happen. Some examples are summarised in our book *Case Studies in Ecotourism* (Buckley, 2003). Effectively, ecotourism can channel money from well-off people in rich countries, directly to park managers and local communities in poor countries, helping them to resist pressures to hunt wildlife, sell timber or clear land for crops. Research on how well this work, what it's worth and how to do it better is all biodiversity research that matters.

In addition, only about a tenth of the world's land surface is in effective protected areas. Most of our currently remaining biodiversity depends for survival on other private, public and community lands which are not protected. So tourism may be a tool not only for the establishment of more protected areas, but for protection of biodiversity in other types of land tenure, and also in the ocean. Not a very strong tool, but one of the few we have, given the political strength of the various extractive industries. This may be as important in developed as developing nations. Both in the USA and in Australia, for example, tourism in public forests generates far more income, per unit area, than logging; and forestry agencies are gradually beginning to recognise this. Likewise, farmers in many countries are turning to tourism to supplement or replace income from agricultural commodities. And in either case, to the extent that the demands of tourists keep land in a less disturbed state than other industries, tourism can contribute to biodiversity conservation. Again, research on the economics of ecotourism, the growth of farm and forest tourism, and the adoption of private conservation covenants associated with tourism is biodiversity research that matters.

Tourism itself has impacts, however, and these are of increasing concern in and around protected areas in developed nations. Visitor numbers and demands continue to escalate; and political, economic and legal pressures on protected area managers force them to spend conservation funds on visitor infrastructure, to open wilderness areas to heavy public use, and to enter into deals with commercial tour operators, often under disadvantageous circumstances. At the same time, real estate developers use tourism and associated amenity migration as a lever to gain access to areas of high conservation value immediately adjacent to parks, and sometimes even inside them. Our recent book on *Environmental Impacts of Ecotourism* (Buckley 2004) reviewed existing scientific knowledge on these threats, and showed that relevant research is very sparse, patchy and in many cases rather crude. Commercial tour operations are thus continuing to threaten biodiversity with rather little understanding of the impacts they produce. Recreation ecology research certainly matters to biodiversity conservation, and so does research on trends in tourism, recreation and amenity migration.



In general, it appears that in existing protected areas in developed nations, the role of tourism as a threat to biodiversity outweighs its role as a tool in conservation. In developing nations, and in other land tenures in developed nations, however, its value as a tool in conservation may outweigh its role as a threat. This difference between countries may be seen as part of the so-called “North-South divide” (Buckley 2002). The most detailed study in recent years was carried out by Conservation International (2003) under the title Mapping Tourism’s Global Footprint, available on the and the United Nations Environment Program website. These issues were also considered at the World Parks Congress in South Africa last year, and at the Barcelona Forum in mid 2004.

Further information:

The Ecoclub Interview, October 2004. Ecoclub, 64.

<http://www.ecoclub.com/news/064/interview.html>

The International Centre for Ecotourism Research, [www.gu.edu.au/centre/icer](http://www.gu.edu.au/centre/icer)

## Taming the Superlatives

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**John Shores**, Sustainable Development Consultant, San Jose, California, USA

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**SUMMARY:** Tourism, the subject of this forum, is important in the global economy but it is definitely not the biggest player. Agriculture occupies a larger share of the labour force than does tourism, especially in developing countries where much of the biodiversity interest is focused. And retail trade generates more in revenues than does tourism.

Keywords: tourism, agriculture, labour force, retail trade, revenue

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In our quest for superlatives to use in describing our work, we are prone to claim (and repeat other's claims) that tourism is variously the biggest, fastest growing, or largest earner of foreign currency. I admit that it is comforting to feel that our chosen field is not fading away, but we need to keep the proper perspective.

Tourism is dependent on discretionary income. The tourism industry contracts during recessions and slows during economic downturns. For the four billion people in the world living on less than four dollars a day, becoming a tourist it is not even a distant dream.

The tourism industry is dynamic, with dramatic ups and downs. Destinations and entire countries fall into and out of favour. If the conservation of biodiversity is conditioned on adequate tourist dollars pouring into a country, what happens when the flow of tourists slows? The impacts of these dynamics on biodiversity are essentially unstudied. In spite of great photographs and entertaining anecdotes, we still have a long way to go to demonstrate in a convincing way that nature-based tourism is good for biodiversity over the long term.

If I sound too pessimistic, perhaps it is because the superlatives sound too optimistic. While I am confident that global markets will continue to offer high-quality tourism experiences, and tourists will continue to seek high value for their tourist dollars, I see no reason to expect that the conservation of biodiversity will be a major or even a minor consideration in what will be basically economic decisions.

Research on the roles and values of biodiversity within the tourist economy may help us to convince politicians and other decision makers of the need to consider long-term biodiversity values. But tourism could just as easily become a commodity product, and the tourist industry be viewed as a short-term extractive industry, if alternatives appear that offer higher returns of investment. The existence of Disneyland and safari parks clearly demonstrates that many tourists don't know the difference or don't care.

I want to acknowledge the work of Dr. Robert Healy at Duke University, who has done considerable work on some of the themes in this short essay, especially the connection between ecotourism and agriculture.

## Limits of Acceptable Change (LAC)

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**John Shores**, Sustainable Development Consultant, San Jose, California, USA

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SUMMARY: Limits of Acceptable Change (LAC) is a system for applying adaptive management to the problem of assessing and monitoring cause and effect on ecosystems. LAC provides a straightforward method for managing the impacts of tourism on biodiversity.

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Limits of Acceptable Change (LAC) is a well-developed system for guiding the principles of adaptive management to the problems we have been discussing related to the impacts of tourism on ecosystems and biodiversity. I view LAC as the next evolutionary step after Carrying Capacity (as I recall, Carrying Capacity was developed first in the field of animal husbandry and later was applied to wildlife management). Carrying Capacity approaches to managing tourism and visitor impacts tended to take a worst-case scenario approach to tourists. We perhaps cynically assumed that all tourists were equally bad or destructive for a fragile environment, and we restricted access by setting a carrying capacity (a maximum number of these generic tourists) for the landscape or seascape in question.

LAC recognizes that all tourists are not equal. A minimum-impact trekker does not have the same impact as an off-road 4WD recreationist. So we set thresholds (Limits) for the amount of change a given ecosystem or habitat can absorb (Acceptable Change). Then we adapt our management of the ecosystems and the tourist impacts to try to stay within those limits.

A separate LAC scheme does have to be defined for each ecosystem / habitat / landscape being considered, so there is a significant amount of work involved in setting up the system. Although this may sound like it requires a lot of scientific research, in practice the hardest part usually is getting the stakeholders to agree on the limits.

There is a considerable body of literature (mostly in English) dealing with limits of acceptable change and carrying capacity, with a significant amount addressing tourism and visitor issues specifically.

## Tourism and Biodiversity research priorities

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**Rachel Dodds**, Sustainable tourism consultant, [Sustainabletourism.net](http://Sustainabletourism.net)

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**SUMMARY:** The author describes the economic importance of tourism and its impacts on socio-economic and environmental parameters, and lists key research priorities to achieve the requirements for sustainable tourism.

**KEYWORDS:** Sustainability, policy.

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Tourism accounts for roughly a tenth of global employment and capital formation and approximately a fifth of global GDP. Tourism employs approximately 212 million people worldwide and there was an increase of 1.8 million jobs in 2002 over 2001 (WTTC, 2002). Tourism figures have also grown substantially. In 2001, worldwide arrivals were just over 692 million people and worldwide receipts were over US \$463 billion (WTO, 2002). The World Tourism Organization (WTO) forecasts that international tourism will reach 970 million international arrivals with receipts of US \$1.5 trillion by 2010. Of the 220 million international arrivals to Europe in 2003, one third was recorded in Western Mediterranean countries, mostly in coastal areas (Yunis, 2000). Tourism receipts amounted to 127 billion in the Mediterranean (the world's leading tourism destination).

Tourism dollars, especially for a destination dependant on tourism will result in both the positive and negative export of services, economic development (infrastructure, transportation, agriculture) and impacts on the local economy. Probably the main political and social stimuli and motivations for developing a tourism industry at all derive from its assumed potential to generate employment and economic development; however regions must also consider the growing threats to their environmental and social carrying capacity.

Some of the issues and impacts affecting tourism areas (specifically coastal areas and small islands) include but are not limited to:

- Loss of habitat areas and resources due to development and pollution
- Decline in biodiversity of species and ecosystems
- Coastal erosion
- Loss of natural and architectural heritage in the face of rapid expansion
- Decline in quantity and quality of water resources
- Sea, land, noise and air pollution
- Traffic congestion
- Rapid decline of traditional pursuits by locals because of a change in habits due to tourism
- Excessive use of natural areas
- Crowding and pressure on services
- Displacement of local population
- Inflation
- Foreign customs and expectations creating conflicts

More than 40% of the beaches along the Mediterranean coasts of Europe are affected by erosion and one million hectares of wetlands in the past 50 years have been lost (UN, 2003). Many tourism development and resorts have not had any environmental or social considerations in their planning.

To achieve sustainability, tourism must look at existing major problems in the industry rather than just concentrating on new developments and must be holistic and integrated in its approach. To achieve a more sustainable form of tourism, the following criteria should be outlined:

- Protect and conserve resources
- Offering a multi-stakeholder approach
- Be environmentally responsible
- Maintain the well-being and involvement of the local population
- Be economically beneficial
- Have a long-term view

- Be equitable
- Foreign customs and expectations creating conflicts

Based on the growth of tourism and its effects, there is a need to consider how these regions can be contained, preserved and managed addressing the triple bottom line: economic, social and environmental. Applying principles of sustainability and policies to tourism development can have more benefit with respect to economic environments and can potentially be less harmful to both physical and human environments than developing obscure new regions.

Currently there is vast amounts of research about both the positive and negative impacts of tourism, however, there is relatively little on tourism policy relating to sustainability. The most strategically important issue for research to focus on is policy to address principles of sustainable tourism and how to implement these policies in a practical, holistic and integrated approach.

## Biodiversity and tourism in Romania

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

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**SUMMARY:** Romania has great potential for both scientific and tourism interest in biodiversity. In general context, the space for biodiversity is constantly reducing at an alarming rate. So my question would be: Which institutions are better placed to prevent and control the tourism industry in order to avoid permanent damages to local biodiversity?

**KEYWORDS:** Romanian biodiversity, tourism control

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The territory of Romania covers the highest diversity of European biogeographic regions: continental, pannonic, alpine, pontic and steppic. The last two biogeographic regions are not even represented in the enlarged EU of the 25 states. While the pontic biogeographic region is also present in Bulgaria, the steppic biogeographic region is present only in Romania. Both biogeographic regions host a large number of species. In Romania, there are also isolated fragments of the primary forests that survived in limited areas of Europe. Total surface of primary forest is 246,700 ha and 44,498 ha are included in protected areas (Giurgiu V. & al., 2001). While the Habitat Directive 92/43/EEC prioritises 65 out of 198 European types of habitats, in Romania 24 out of 94 of such types of habitats are established as priorities (as listed in Annex 2 of the Romanian Law No. 462/2003), since their conservation requires the designation of special areas of conservation. Romania has 3,700 higher plant species from which 57 are endemic, 171 sub-endemic and 1,253 rare; of these, 39 species are considered endangered and 171 vulnerable (Oltean M. & al., 1994). At the same time, the Romanian Red Book of Vertebrates includes: 40 Pisces, 17 Amphibians, 19 Reptilians, 72 Aves and 72 Mammalian species. From the total number of 827 scientific reserves, natural monuments and nature reserves, 134 are inside the biosphere reserves, national parks and natural parks and 693 are outside (as listed in Annex 1 of the Romanian Law 5/2000).

The richness of knowledge and traditional customs connected to spontaneous and cultivated plants, wild and domestic animals must be ascribed to the vitality of Romanian culture and civilization as also to the continuity of Romanian people in Danubian-Carpathian-Pontic space. As integrant part of inter-disciplinarity we may underline here the influence that plants and animals had and have upon the Romanian folk costume and upon artistic creations, respectively literature, painting, sculpture, design. Romanian folk costume has particularities from one region to the other. Floral and animal motifs though, are present in each region. Traditional Romanian handicrafts had most of the times benefited from the influence of floral and animal motifs. Ethno-botanical knowledge of Romanians is part of a traditional cultural treasure of great importance both in understanding our folk culture and the study of ethno genesis of Romanian people. All these facts confirm that Romania has a great potential for both scientific and tourism interest in biodiversity.

After the 1989 revolution, the socio-economic changes influenced tourism activities in different ways. Although Romania has a tradition for mountain climbing and other recreation activities, we are at present noticing that a great number of tourists have no respect for marked paths or special campsites. Another very important aspect of socio-economic changes is the increase in the number of buildings for recreation situated in mountain and beach areas and also in the vicinity of protected areas. In this way the uncontrolled tourism affects large areas. In this general context, the space for biodiversity is constantly reducing at an alarming rate.

The Ministry of Tourism has been preparing the National Ecotourism Strategy for natural, national and biosphere reserves in Romania. The ecotourism development style must be required to meet the principles of ecotourism, occur in a natural environment, include environment education and interpretation elements, and contribute to conservation. The planning model must combine the opportunities offered by the tourism and by the protection and sustainable development of the natural and cultural resources, integrated in local traditions. Both the evaluation of the environment and tourism resources, and the evaluation of environmental impact and recreational compatibility, are very difficult. The responsibility

for the elaboration of such strategy is conjugate to both scientific and administrative duties of state institutions.

So my question would be: Which institutions are better placed as to prevent and control the tourism industry in order to avoid permanent damages to local biodiversity?

## **Tourism and Biodiversity questions**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Imagine that you are the co-ordinator of a biodiversity project in the theme of this discussion. Your consortium, composed of some excellent teams from all across Europe and from countries outside Europe, includes social and natural scientists and economists. You have received a grant of 10 million.

What is the question, or what are the questions, that you and your consortium are trying to answer?

Can you phrase it in just a few words: Is there life on Mars? How do marsupials keep their pouches clean? Do cell-phones fry your brains? How much plant life is needed to keep a person alive in a sealed room? Can humanity survive?

## **RE: Tourism and Biodiversity questions**

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**Erling Berge**, Department of Sociology and Political Science, Norwegian University of Science and Technology, Trondheim, Norway

My question would be: “What policy interventions make a difference? Disentangling the impact of policy interventions from ecosystem dynamics and impacts of activities other than those shaped by biodiversity relevant policy interventions”

## **RE: Tourism and Biodiversity questions**

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**Jeff McNeely**, IUCN

Colleagues: Here’s another one: How can I use that measly \$10 million to generate sufficient funds to actually make a difference?

## **RE: Tourism and Biodiversity questions**

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**Ron Mader**, Planeta.com

I respect the optimistic note that this question poses ... but I think instead of making a wish list of what should be funded, we should ask whether current funding is conducted in an appropriate manner.

Most sustainable tourism financing has been conducted behind closed doors without adequate public consultation or evaluation.

This is what has prompted the development of the Sustainable Tourism Bank Watch

<http://www.planeta.com/ecotravel/tour/bankwatch.html>

<http://forum.planeta.com/viewtopic.php?p=336>

More money is NOT the answer. Rather, we should be focusing on improving communication and collaboration, a topic I raised in my 2001 presentation for the UN on integrating biodiversity and tourism using the Web  
<http://www.planeta.com/planeta/01/0103integrate.html>



## More on the 10 Million Euro issue

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**Jan Marcin Weslawski**, Institute of Oceanology PAS, Poland

Here is my opinion on how to spend money on biodiversity research that is related to tourism/trade/policy in the European area.

The general question is: What part of current biodiversity is needed for the quality of human life in Europe?

Considering that:

- 1) Part of biodiversity is directly used for sustaining our life (food species)
- 2) Part of the biodiversity is needed to sustain our food species
- 3) Part of the biodiversity is needed for our biophilia, sense of beauty, aesthetics, culture etc.
- 4) Part of the biodiversity is needed to keep the basic biological processes (e.g. decomposition of organic matter)
- 5) Part of the biodiversity is redundant, is a reserve, insurance of Nature, of no direct relation to human well being

What is the ratio between the five components? Which of the five components is threatened most? Which of the five components needs our action to protect it?

The answer might be, that we can be healthy and happy with 5 habitats, 10 charismatic species, 20 food species, and 1000 supporting species. In such case we shall focus on the conservation and sustainable use issues.

But the answer might be, that we are directly and indirectly dependent on the huge amount of still unknown creatures. In this case we shall focus on further research on the unknown diversity. If it matters, we shall study its richness.

## RE: More on the 10 Million Euro issue

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Università di Lecce, Italy

Excuse me if I am always here. These things are interesting to me and I enjoy this discussion a lot.

The National Science Foundation is investing more than 10 million dollars in biodiversity issues. It is called the Partnership for Enhancing Expertise in Taxonomy. Each PEET project is 750.000 dollars, and they have over 20 of these. So the sum is higher. Their line of reasoning is simple:

- In order to study biodiversity we must know the species (I know it is not enough, but it is a necessary step).
- The people who know the species are taxonomists.
- Taxonomists are disappearing.
- We must train new taxonomists (of course not the “corpse in the vial identifiers”)
- The training of a taxonomist requires at least 5 years
- Then we have to enforce a policy that will give them jobs (money available for revisionary work and the like)

Here in Europe we speak about biodiversity a lot, and we invest lots of money in it. We also agree that the people who recognise and describe species (also identifying their roles, and phylogenies, you name it) are disappearing. But we do not invest a single cent to train more. And if a young researcher goes into taxonomy, s/he has to be prepared to face unemployment and frustration.

We need money and we need a policy. In Europe, both are missing. Paradoxically, we are the country with the longest tradition in taxonomy, and we are losing it. The Americans destroyed theirs and now they are desperately trying to build a new generation of taxonomists. We still have them (they send theirs to learn from us), but soon they will be gone. We are not taking advantage of a favourable situation.

I know that this is disturbing. Nobody dares say that taxonomy is useless, but once they have admitted it they want to go on without it anyway.

So, my answer to all these questions is: you cannot study biodiversity without a proper knowledge of taxonomy (and then we can discuss about what is taxonomy now, it is surely not only giving names to taxa). Are we enforcing a policy to revive taxonomy? The answer is no, we are not. Even Science and Nature have stressed these issues, but then the policy remains the same. You know why? Because taxonomists are not influential, and the people who sit in the steering committees (scientists!!!) do not like to see that research money might go in directions that are not theirs. Politicians are maybe ready to do something, but their advisors do not want such a policy. People make things, and if things are going in a certain way the responsibility is of some people (the guys who are always at Brussels, know how to move in the corridors and know where the offices of the right functionaries are).

I said this story already: I went to two big meetings to launch research on taxonomy and went away with lots of frustration. I do not want to invest my time in these enterprises anymore. I'd rather work at the Hydrozoan Fauna of the Mediterranean while these guys build up their beautiful database that spread information and do not increase knowledge.

By the way, according to the NSF standards, with 10 million euros you can train about 30 taxonomists. For all Europe it is not much, it does not even cover all known phyla. And you know better than me that there can be a single specialist in the world for a single phylum, but there are phyla that require much more than one specialist. I've been saying these things for a very long time and I found support from the NSF, but not in Europe.

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**RE: More on the 10 Million Euro issue**

**Anne Franklin**, Royal Belgian Institute of Natural Sciences, Invertebrates Department, Brussels, Belgium

Thanks for your dynamic input to all the themes addressed by the electronic conference!

I would like to bring a positive experience to the issue you have raised. The major taxonomic institutions in Belgium - Royal Belgian Institute of Natural Sciences, Royal Museum for Central Africa and the National Botanic Garden - are trying to do something about training a new generation of taxonomists. It is a very modest contribution, as our yearly budget is far beneath that of PEET, but it is a hopeful start. Our approach is oriented specifically towards developing countries - with 80% of the world's biodiversity and 6% of the taxonomists - and is twofold:

- Top-down: experienced taxonomists from Belgian institutions identify important taxonomic impediments and tackle these by carrying out in situ research projects with a strong training component.

- Bottom-up: interested parties from developing countries identify key taxonomic and/or collection management needs. Through call for proposals, the Belgian institutions make available their expertise, collections and other information to meet the needs.

What I would like to stress is that, with the right lobby and with the right arguments, it IS possible to convince the policy makers that their funding will not be wasted if they invest in taxonomy. The Belgian Development Cooperation has understood that, and has granted the RBINS and RMCA funding for training activities. As the persons who did the lobby are taxonomists, it appears that it is not impossible to conciliate the worlds of science and policy ... with a little effort from both sides.

If you are interested to have more information on the training programme for developing countries, feel free to contact the Belgian GTI Focal Point at [cbd-gti@naturalsciences.be](mailto:cbd-gti@naturalsciences.be)

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**RE: More on the 10 Million Euro issue**

**Francisco Pugnaire**, EEZA, Almeria, Spain

A philosopher friend of mine tried several years ago to define what Science is. His only conclusion after several months of reading and thinking was “what scientists do”. So to answer Martin’s question “What biodiversity research should be financed in the 7th Framework Programme?” I would suggest that, in addition to visit the web page he mentioned, browsing through the 300 outline proposals received by the EuroDiversity/Eurocores call. This may be a way to know what concerned scientists are willing to do in the field of biodiversity. Since only 5-7 % of those proposals will be funded because of the limited amount of funds, there may be plenty of good science left in these grass-root initiatives worth funding.

## **RE: More on the 10 Million Euro issue**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Thank you again for another interesting and provocative comment. While I agree with the spirit of much of what you say, I feel that I must try to correct the impression that the EU Framework Programme has not financed taxonomic work. But before I do that, I think I should point out that the problem is not so much a research issue as an educational one, coupled with a career problem.

The educational issue: How many universities in Europe offer degrees in morphological taxonomy these days? And the image of the taxonomist, back bent over yellowing bottles of formaldehyde or methyl alcohol for years on end, is not altogether appealing to everyone who might make a good taxonomist. Molecular methods are far more fashionable. And without the training, is it a surprise that we have no taxonomists? Scientists are not to blame - but their complaint that there are no taxonomists any more is falling on deaf ears. As is so often the case, the pain is not felt by the people who hold the power of decision, so the decision is made - again and again - in a way that does nothing to reduce the pain.

The jobs issue: where are the careers in morphological taxonomy? Most museums are under increasing pressure to make money, and the loss of a taxonomist (upon retiring) may be viewed by hard-pushed management as one less salary to pay, rather than reduced capacity to produce good science. So we seem often to see that retiring taxonomists are not replaced, and even if they are, there seems little opportunity for advancement up the career ladder. Once again, molecular methods, modern, rapid, constantly improving, are generally more attractive, seem more go-ahead and dynamic.

Now back to the financing of taxonomy in the last few framework programmes. Perhaps the simplest way to do this is to list the European collection-based projects that have been financed. I’m pretty sure that this list is not exhaustive:

1. ABC - an IHP project to allow European biodiversity researchers to work on Belgian collections
2. BIOCASE - A Biological Collection Access Service for Europe established web-based access to biological collections in Europe
3. BioCASE provided a web-based information service that gives researchers access to biological collections in Europe
4. BioCISE Resource Identification for a Biological Collection Information Service in Europe prepared a strategy for a Biological Collection Information Service in Europe
5. BIOD-IBERIA - an IHP project to allow European researchers to carry out biodiversity research at the Museo Nacional de Ciencias Naturales and the Real Jardín Botánico
6. BIORESOURCE - an IHP project to allow European researchers to carry out systematics research at the British Natural History Museum, the Royal Botanic Garden, Kew and the Linnean Society of London.
7. CDEFD prepared a data structure for European floristic databases that provides taxonomic, nomenclatural, ecological, bibliographical, and geographic views of biological information

8. COBICE - an IHP project to allow European biodiversity researchers to work on the collections of the University of Copenhagen Biosystematics Centre
9. COLPARSYST - follow-up to PARSYST
10. ENBI - The European Network for Biodiversity Information is a network of biodiversity information centres of the western European palaeartic that offers European researchers access to a Europe-wide pool of technical and human resources, expertise and know-how on biodiversity. It provides a forum for GBIF-related discussion and decision-making on scientific issues that are better handled at a European scale than at a national one. ENBI complements and adds value by co-ordinating other relevant research activities in Europe.
11. ENHSIN - European Natural History Specimen Information Network, developed an infrastructure of European natural history specimen databases
12. ERMS - European Register of Marine Species produced a register of marine species in Europe
13. EURO+MED Plantbase provided an information system for the vascular plants of Europe and the Mediterranean region
14. EuroCat will enumerate and provide web access to basic taxonomic information on all known species of plants, animals, fungi and microbes on Earth: see Species 2000
15. EUROPHLUKES develops a database of photos of cetaceans
16. Fauna Europea assembles a database of the scientific names and distribution of all existant multicellular European land and fresh-water animals.
17. HIGH LAT Access to Naturhistoriska Riksmuseet - High Latitude - an IHP project to allow European biodiversity researchers access to the collections and facilities of the Swedish Museum of Natural History (Naturhistoriska Riksmuseet)
18. PARSYST - an IHP project to allow European biodiversity researchers access to the systematics collections and facilities of the Paris Natural History Museum
19. SYS - RESOURCE - a follow-up to BIORESOURCE
20. TAXIP - a project to allow biodiversity informatics researchers access to facilities in taxonomic information processing of the Zoological Museum, University of Amsterdam
21. SYNTHESYS - An important new initiative is the Synthesis of Systematic Resources. This project, which evolved from partner involvement in 14 Access to Infrastructure grants, focuses on access (to data, collections and expertise), policies and standards relating to the large natural history collections of Europe. It aims to create a single virtual museum by providing integrated access to collections, facilities and databases from 19 European natural history collections.

The third call in the present framework programme asked for proposals for a network of excellence in taxonomy. The evaluation of the resulting proposals will take place at the end of this month. At stake is an opportunity to access some 10 million euro or more to set up a network of taxonomic organisations.

I agree with you that the NSF has an admirable attitude towards financing taxonomy. From the projects you cite, through the Assembling the Tree of Life initiative and its contribution to the All Taxa Biodiversity Inventories, the NSF has done wonderful things. We in Europe must do what we can to contribute energetically and effectively to this vital work. And what can we do? Well, among other things, say what we think should be financed in the 7th Framework Programme.

Go to [http://europa.eu.int/comm/research/future/themes/index\\_en.html](http://europa.eu.int/comm/research/future/themes/index_en.html) and put your point of view about what thematic research should be financed. If you don't do it, do you hope that someone will read your mind?

#### **RE: More on the 10 Million Euro issue**

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**Anne Franklin**, Royal Belgian Institute of Natural Sciences, Invertebrates Department, Brussels, Belgium

I agree that the Commission has funded a truly vast number of collections-related initiatives.

When looking at the list you give in your message, it appears that about all projects either deal with:

- Access to collections
- databasing / information networks

This is great!! But it is clearly not sufficient to fill in the knowledge gap. What are still lacking in Europe are opportunities for the science itself, as PEET is trying to address.

I agree that the biodiversity/taxonomic community absolutely needs to make a contribution to the public consultation for FP7. This is the chance for (massive?) lobbying!

### **RE: More on the 10 Million Euro issue**

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**Hendrik Segers**, Freshwater Laboratory, Royal Belgian Institute for natural Sciences, Brussels, Belgium

The views expressed Martin on taxonomy and taxonomists prompt me to reply. I'm perplexed by Martin's perception of taxonomy and taxonomists ("morphological taxonomy", "...the taxonomist, back bent over yellowing bottles.... for years on end"). Contemporary taxonomists use all available and necessary tools, including molecular ones, to tackle scientific questions. Taxonomists are scientists. The vision on taxonomy as an obsolete occupation, which, unfortunately, can be heard at many forums and is sometimes even promoted by researchers competing with taxonomists for funding, does not correspond with reality. But it does constitute a major hindrance to addressing the taxonomic impediment.

May I suggest you to attend a scientific meeting in the field? There are still quite a few of these organized, here and there, now in then, in Europe. You'll be amazed.

## **The last contribution from Ferdinando**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

I refrained from writing because I realise that this e conference has gone in a completely different direction than was expected by the organisers. But the two questions that were posed (how to measure biodiversity; what to do with biodiversity money) evidently are of great interest for a lot of us. Maybe it might be nice to launch a forum on this, so that people who have (maybe) some possibility of doing something political (Martin?) can be aware of what a part of the scientific community think.

The issues are:

It is true that the way Martin depicts a taxonomist is obsolete. And it is true that there are many of these taxonomists. This means that we need a policy to produce a different brand of taxonomists, and they are not only molecular. This policy is not enforced in Europe.

It is true that what Martin says (there is a lot of money to support biodiversity: look at this list of projects) is correct, but it is also true that all these projects (as well argued by one of us) are aimed at providing services (types and lists) and not at producing research. I wonder who will use these services, since there are no more taxonomists and there is no funding for them (after all they either look at molecules and do not need types, or they inspect corpses in vials and are useless). It is evident that all this money has been given to people who do other things than taxonomy. So we need a policy to fund real taxonomy, and not services for non-existing taxonomists.

Martin is right in saying that the EU cannot read our minds. So we have to raise our voice and say it loud. Most of the times I found myself alone. I went to the launching meetings of GBIF (Paris) and ENBI (Stockholm) and my voice was alone in the desert. I try to say these things in MARBEF and I have the same result. I start to be tired, and lots of people dislike me because of what I continuously say. Then, at meetings, lots of people approach me and say that they agree. But they say it in private. This is the first time that so many people agree with me (besides in the US, of course). Let's stick together folks.

## **RE: The last contribution from Ferdinando**

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**Franz Uiblein**, Institute of Marine Research in Bergen, Norway

I am in agreement with most of your points, especially the launching of a forum for measuring biodiversity. But disagreement with your statement that "all this money has been given to people who do other things than taxonomy" referring to the projects Martin has listed. From my own experience I know that, for example, COBICE that allows researchers to work on the collections of the Copenhagen Biodiversity Centre, has been very successful so far in enhancing fish taxonomy work by (partly young) Europeans in high biodiversity areas like the Canary Islands or the Indo-Pacific. But certainly such facilities could be used even better, if there would be money to educate and support young scientists to a further point than just reaching a master's or a PhD title.

## **Social carrying capacity in tourism**

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**Silva Marzetti**, Department of Economics, University of Bologna, Italy

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**SUMMARY:** When crowded situations occur at tourist sites, the social carrying capacity (SCC) from the point of view of both residents and visitors has to be estimated; therefore it is important to stimulate research on the different aspects of the SCC and their methods of estimate, and also to favour knowledge-spreading about SCC amongst policy-makers.

**KEYWORDS:** sustainable tourism development, social carrying capacity

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The sustainable use of natural resources for recreational activities and tourism requires the management of all resources in order to fulfil economic, social and aesthetic needs, and to maintain ecological processes, biological diversity and life support systems (Council of Europe, 1997b). In the Recommendation No R (97) 9, the Council of Europe (1997a) specifies some criteria to be satisfied by a “sustainable environment-friendly tourism”; in particular, amongst the general principles for a “balanced tourism development”, it is highlighted that tourism should be limited “to a level compatible with the ecological and social carrying capacity (SCC) of the site”.

A tourist system is an integrated system constituted by at least three different sub-systems, i.e. the ecological, social and economic sub-systems; therefore tourism carrying capacity is the result of the carrying capacities of all those sub-systems (Seidl & Tisdell, 1999).

In well-developed tourist sites the natural environment is generally sacrificed heavily to economic growth, and attention is on the dimension and kind of social interaction between visitors and residents, and also between visitors themselves, since crowding is very frequent at these sites. Therefore tourism SCC is defined from the point of view of visitors and of residents: i) as regards visitors, SCC is the maximum number of other visitors that the majority of visitors are willing to accept without reducing their own enjoyment; ii) as regards residents, SCC is the maximum number of visitors tolerated by the majority of residents (Marzetti and Mosetti, 2003).

These two aspects of the SCC may be in conflict: the maximum number of visitors tolerated by the visitors themselves may be different from the maximum number tolerated by residents. In case of conflict, tourism policy making should be the result of a compromise between the need to preserve residents’ life style and to increase economic benefits from tourism. In conclusion, when crowded situations occur at tourist sites, the SCC from the point of view of both residents and visitors has to be estimated; therefore further research is required on the different aspects of the SCC and their methods of estimate, as well as promoting knowledge about SCC amongst policy-makers.

## **Biodiversity Protection through Community Ecotourism in the Ecuadorian Chocó**

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**Mary Finn**, University of California, USA

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**SUMMARY:** The author describes the difficulties encountered during the development of a community ecotourism operation in the Ecuadorian Chocó, and asks for more research into the social and cultural aspects of such projects, to determine whether adaptive management methods may help increase their success rate.

**KEYWORDS:** Ecotourism, pitfalls, biodiversity, social issues.

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Community ecotourism offers significant potential for promoting conservation and protecting biodiversity, but for this potential to be fulfilled - and sustained - strategies are needed to address underlying social issues as well as biological and financial ones. Ways must be found to create projects, organizations, and even networks, which learn from the past and from each other, and improve and adapt (Salafsky et al.). And measures must be taken to ensure that all important stakeholder groups - community members, tourism professionals, conservation biologists, and community development specialists - collaborate effectively together in ecotourism planning, implementation and on-going monitoring.

These conclusions come from direct experience with a community ecotourism project in the Ecuadorian Chocó. This community owns several hundred hectares of montane cloud forest in one of the most diverse bioregions in the world. Their ecotourism project was “bootstrapped” with significant volunteer effort and minimal outside funding. Scarce funds were thus directed to the most urgent, short-term needs - i.e., building infrastructure, training guides, cooks and administrators, and promotion. Later funding was obtained for specific conservation activities such as reforestation and additional land purchases. But it was much more difficult to find funding for the less tangible, but nonetheless crucial, tasks of leadership training and community development.

The ecotourism project has had many positive impacts on biodiversity protection. Most importantly, locals realized their forest was most valuable left intact. They prohibited clear-cutting (slowing habitat loss) and hunting, and restricted agricultural activities, expecting ecotourism to offset the loss of this income. However, when expected ecotourism income did not meet expectations, many were disillusioned. And without effective skills for managing conflict - and for learning from and adapting to past mistakes - these problems remain unresolved, and now threaten community unity and the ecotourism/conservation project.

Biodiversity protection was also sometimes given a lower priority to income-producing activities. A typical incident involved a local guide who chopped down the small tree in which a spectacled bear cub (an endemic, endangered species) was stranded, in order to give visitors a good look at the animal. Another involved a trail built without a biological survey or impact analysis. Increased human presence disturbed a local herd of wild pigs, displacing them to lower elevations where many were hunted by poachers. The community also had difficulty enforcing norms for visitors, including some whose insensitive behaviour (loud parties, drinking, overt sexual behaviour) threatened local culture and social systems, if not biodiversity. Traditional authoritarian leadership and cultural biases against verbal directness discouraged open discussion of these problems, so that the community has been prevented from learning from and correcting these mistakes.

Many community ecotourism operations fail within the first years, and I suggest that research is needed into the social and cultural aspects of both successful and “failed” projects, to determine whether adaptive management methods may help increase the success rate, in terms of all the important objectives, including the protection of biodiversity.



## **Tourism and Biodiversity session research priorities**

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**Adriana Vella**, Biodiversity & Tourism session Chair, Conservation Research Section, Biology Department, University of Malta, Malta

I would like to take this opportunity to thank all contributors to the Tourism session on biodiversity research that matters, for their varied and interesting thoughts and experiences. From the various contributions that we have shared, it is obvious that the topic of Biodiversity and Tourism still requires research and policy considerations and improvements. While many contributions have considered and contested the extent to which tourism is of economic importance in various parts of the world, it becomes clear that several contributors felt that the challenge in biodiversity-tourism research will include an integration of the ecological, social and economic benefits, impacts, limits to acceptable changes of these factors in relation to tourism and its carrying capacities.

The reasons why biodiversity may or may not be so important to the tourist were overviewed in this session, but the indirect and direct roles of the various characteristics of biodiversity in the tourism sector could not be dismissed. The value of biodiversity as a life supporting system, as an aesthetic/pleasure giving bonus, as the habitat/ecosystem requirements for certain charismatic organisms, as the basis for diversity in landscape and cultural uniqueness, as the necessary setting for adventure, nature, and ecotourism oriented travel may all be considered pertinent to the tourist activity. For example, many Mediterranean countries depend a great deal on their tourists for their economies. Indeed such countries may have gone a long way to alter their environment to be tourist friendly, with beautiful hotels fully equipped with all necessities and commodities, leaving very little time and space for nature appreciation outside the hotel doors.

While we all probably agree that not all tourists give much consideration to the biodiversity in the country they visit, we cannot ignore the substantial and increasing number of persons that seek to take their break from their ordinary routine life by seeking comfort or excitement, ideally in a natural and beautiful setting. Whether nature is beautiful or whether beautiful settings need to be natural may be issues for opinion surveys among tourists, but will it really target the needs of sustainable tourism? Would it really provide us with the answers we need in protecting more effectively biodiversity in regions and sites that are increasing the tourist load with no monitoring or efficient management? And what would efficient management need to take into consideration when planning and directing tourist activities in a region that needs to be shared between nature protection, social and cultural needs and economic welfare?

If indeed biodiversity is an essential component of life on earth, can we afford its loss for the quick economic profits, when research and planning (including policy implementations), may guide us toward environmentally friendly, sustainable and economically viable tourism?

Perhaps one of our prime aims or stimulus for prioritising research requirements in this tourism-biodiversity intersection needs to go beyond the important consideration of future funds available for these research needs, to focus on how current expenditures and tourism profits are directed toward or away from effective conservation of biodiversity. How can countries that have signed up to various international conventions and agreements for the protection of important habitats and species, still not consider the serious integration of various research and implementation strategies toward necessary targets such as that of sustainable tourism? This may highlight a gap in the current research arenas or call for greater collaboration between research and policy in this area to better address local and national requirements?

The national biopatform structures in certain European countries may be assisting in the latter process, while encouraging more research for faster and more effective results within the 2010 biodiversity conservation target. Different countries will need to address their specific research needs while integrating efforts at European and Global level wherever possible. Toward this end the following research suggestions may be considered as various

options that may be adopted in different countries in different circumstances, but if we needed to focus on getting at the most widespread and urgent research needs what would these needs be?

1. How can we measure and monitor the impacts of tourism on biodiversity?
2. Should such research and monitoring exclude biodiversity research in favour of social science in relation to tourism?
3. How can research include and integrate aspects of tourism management and tourists' destination trends with biodiversity conservation?
4. How can we assess and monitor the ecological footprint of the complete supply chain of the tourism industry?
5. What aspects and characteristics of biodiversity should we measure and monitor in order to obtain the closest and reliable indication of how tourism affects biodiversity?
6. Do the perceptions, attitudes and behaviours of individuals living in or visiting a location relate to biodiversity richness or abundance?
7. To what extent have current schemes, tools, documents and legal structures put in practice effective biodiversity conservation within the tourism industry?
8. As natural environments change due to factors other than tourism, what indicators may assist us in focusing on the biodiversity-tourism interrelationships?
9. Should research focus on improving our integration of information, by using specialized software that may more closely monitor ecological/biodiversity, social and economic factors?
10. Should biological techniques such as taxonomy, play a greater role in research and management for conservation, including locations exposed to tourism?
11. What are tourism positive impacts on biodiversity and how can these be enhanced?
12. How can vulnerable habitats or protected areas be visited with minimal impacts?
13. Can and should mass tourism be changed to eco/environmentally friendly/sustainable tourism in countries where the former has been the norm and biodiversity may have already suffered?
14. How may sustainable tourism, as part of a sustainable development process, be promoted through national and international policy obligations and research monitoring?
15. How can local empowerment of sustainable tourism improve local biodiversity conservation?
16. To what extent has education and information played a role in achieving or not achieving a positive tourism-biodiversity relationship?
17. Should we focus research on the desires of tourists, on the needs of ecosystems from which tourism is obtaining a boost or on how the two aspects interact?
18. When impacts of tourism on biodiversity are clearly negative, what policies and implementations need to be addressed immediately for biodiversity conservation?

Overall research priorities may include:

1. Research on tourism policy relating to sustainability and its implementation.
2. Research on the impacts of tourism dynamics on biodiversity.
3. Research on the roles and values of biodiversity within the tourist economy.
4. Research on the limits of acceptable change for each ecosystem, habitat, landscape due to tourism.
5. Research on the way nature oriented tourism is increasing and affecting positively or negatively the locations/countries rich in biodiversity.
6. Research and monitoring of biodiversity, through the use of taxonomy as well, so as to accurately address the educational and conservation requirements of ecosystems exploited in various ways, including the tourism industry.

Any other final comments/suggestions on research priorities toward assisting tourism that is in respect of biodiversity conservation?

### **Slide on tourism and biodiversity**

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**Cristian Ruiz Altaba**, Laboratory of Human Systematics, University of the Balearic Islands, and Department of the Environment, Government of the Balearic Islands

The discussion on tourism and biodiversity has been very useful for me; because it helped in refining my thoughts for a talk I just gave this precise topic.

Please find the last slide of my powerpoint presentation below. I hope it conveys a sense of summary for all the ideas we have put into the session.





## Biodiversity and Transport

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## **Trade and transport: the missing link**

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**John Shores**, Sustainable Development Consultant, San Jose, California, USA

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**SUMMARY:** The author points out that we often skim over the effects of transport itself when considering biodiversity. Transportation is one of the major contributors to greenhouse gases, and global climate change can adversely affect biodiversity far removed from the producers or consumers in the globalised economy.

**KEYWORDS:** Transport, climate change, greenhouse gases, globalisation.

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In our discussion of trade and biodiversity, we should keep in mind that trade implies transportation. Transportation is one of the major contributors to greenhouse gases. Indeed petroleum-based transportation systems may be the biggest black eye in the globalised economy. If we sum the environmental effects of exploration and drilling, pipeline construction and pumping, shipping and storage, cracking and distribution, and finally fuel consumption and waste cleanup – our petroleum-based global economy may have greater and more widespread effects on biodiversity than any other single industry (or tied with agriculture and forestry).

But I want to draw our attention particularly to the effects of transportation on biodiversity through greenhouse gases and global climate change. This deserves special mention because it may not be obvious or apparent. The bleaching of a coral reef may be thousands of miles removed from the site of an oil field or the person driving a large SUV. Trade makes unfettered consumerism possible by offering more and more products at lower and lower prices. We may not have improved the quality of life, but we sure have moved a lot of materials and products around.

In addition to the direct and indirect effects that Jeff McNeely mentioned in his opening remarks, there are also these dispersed global effects of trade that are no less sinister.

## **Strategy and mitigation measures for reducing roe deer-vehicle collisions in Slovenia**

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**Boštjan Pokorny**, ERICo Velenje, Ecological Research and Industrial Cooperation, Slovenia

In Slovenia, between 4000 and 6000 roe deer are killed on roads each year. Although this number represents an important factor of the mortality of the species (more than 15% of annual hunting bag) and presents a high risk for drivers, no mitigation measures have been systematically implemented on the national scale until recently. Therefore, deer-vehicle collisions were systematically recorded all over the country in the 1999–2001 period. Beside determination of the most problematic sections of Slovene main and regional roads, some statistical analyses were also performed. The most indicative results obtained by the analysis of 7759 records on roe deer road-killed in 206 hunting grounds (representing >60% of the Slovene surface) are as follows: (a) The frequency of deer-vehicle collisions (expressed by the average number of roe deer yearly killed on roads on every 1,000 ha of the surface) is the highest in sub-Alpine and sub-Panonic regions. (b) The risk for collision with roe deer vary over the year – the majority of crashes occurs in April and May; however, a risk is high during the summer and autumn as well. (c) The daily pattern of roe deer-vehicle collisions has a pronounced bimodal distribution with peaks in dawn (5 a.m. – 7 a.m.) and dusk (6 p.m. – 10 p.m.). (d) The risk for collision with roe deer is higher in fragmented landscape, while it is significantly lower both in forest and in agricultural landscapes.

Considering the recent situation, the strategy for mitigation of the problem of roe deer-vehicle collisions was defined. To achieve its main goal (50% decline in the number of collisions on the national scale), the most important issues will be done as follows: (i) testing of the effectiveness of different mitigation measures in a wide range of landscapes and habitat types, adjacent to roads; (ii) determination of the most effective countermeasures for each problematic section of Slovene main and regional roads; and (iii) implementation of adequate measures all over the country. In autumn 2004, testing of several mitigation measures (two modifications of deer warning reflectors, chemical repellents, averting roadside devices emitting ultrasound and terrestrial vibration, formal deer warning signs, and warning panels with dynamic/changeable content) started on 42 sections of roads, dispersed all over Slovenia. We hope that upcoming activities will significantly reduce deer and other wildlife mortality on roads; as such, these mitigation measures (which in principle do not influence animal spatial behaviour, i.e. migration patterns) should also have a positive effect on the conservation of biodiversity in the close vicinity of transportation corridors in Slovenia.

## **Environmental Impact of Transportation**

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**Ron Mader**, Planeta.com

I would like to suggest a review of transportation in a way that draws upon another topic in this e-conference, tourism.

In 2003 Planeta.com hosted an online dialogue on the Environmental Impact of Transportation, particularly as focused on travel. The conference examined how to “get there from here” without leaving an indelible footprint on the environment.

Participants looked at the environmental impact of transportation at local, regional and international levels. The complete dialogue is accessible to the public online <http://www.planeta.com/ecotravel/tour/transportation.html>

A collection of transport-specific links is online <http://www.planeta.com/ecotravel/links/transportation.html>



## Island Biodiversity

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## Island Biodiversity session introduction

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**Phil Lambdon**, Island Biodiversity session chair, Centre for Ecology and Hydrology, Banchory, UK

According to many sources, global losses of species through extinction are currently thought to be occurring at a far higher rate than they have for millennia. In 1996, over 11,000 species of higher plants and animals were considered to be critically threatened according to the IUCN Red List (<http://www.iucnredlist.org/>). This included 24% of all mammal and 12% of bird species. The loss of genetic diversity within species is poorly understood, but may be even more severe. This process is widely attributed to human activities: particularly to changes in land use, climate change, invasions by non-indigenous organisms, abiotic pollutants and overuse of natural resources (Sala et al. 2000).

In recent years, political efforts to slow the decline have led to important steps such as the Convention on Biological Diversity (<http://www.biodiv.org/default.aspx>), which recognized the importance of research and monitoring if this aim is to be achieved. The issue of conserving biodiversity is often particularly acute in island ecosystems, which the CBD cited as an important case study. Of the 94 species of bird known to have died-out in historic times, 85 of them were island specialists (Vitousek 1988). There are a variety of reasons why islands are highly vulnerable:

- 1) They are susceptible to rising sea levels and other climatic changes linked to oceanic systems
- 2) The ecosystems are fragile, often comprising species which have evolved in naivety of aggressive competitors, diseases or predators
- 3) Their small size and separation restricts movement and gene flow, limiting the ability for recolonization following catastrophe
- 4) They are frequently more biodiverse than mainland regions equivalent in size (Hulme 2004)
- 5) They contain high proportions of endemic taxa which can be conserved nowhere else
- 6) They are subject to, or threatened by, heavy tourism pressure
- 7) Human population density can be high, leading to conflicts of land use
- 8) Local communities can be poorly equipped to deal with environmental problems
- 9) Remote islands are often removed from mainstream public attention

Islands encompass a diverse range of territories, differing in landform, climate, isolation and political influence. Each system is unique in biological character. Hence, the key problems to be faced can vary widely, from overexploitation to neglect (e.g., of controlling invaders), and the threatened species can range from well-studied mammals and birds to fish, invertebrates, flowering plants or cryptophytes.

Biodiversity is an immensely complex phenomenon. To understand the processes behind species declines requires not only a knowledge of the causes of extinction and environmental change but also of fundamental ecology: what is required to maintain the delicate equilibrium of an ecosystem? Such a formidable task, in its entirety, is beyond the capacity of science budgets for the foreseeable future, but we can at least focus on those areas where progress is most needed.

The aim of this conference is to identify how science can have the most impact, in real terms, on conserving biodiversity. This remit covers a variety of priorities: to accurately assess poorly-studied taxa or biogeographic areas, to explore ecological interactions, to predict global change and to inform human perceptions of the environment.

In this session, we encourage opinions on these issues: what are our most pressing research needs, and how can science be more effectively translated into active steps in the conservation process? All contributions are welcomed, but please be concise and focused on the key theme.

## Island Development

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**Godfrey Baldacchino**, Canada Research Chair in Island Studies, University of Prince Edward Island, Canada

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**SUMMARY:** Island development and effective biodiversity management may have both much to do with local governance capability and subsidiarity.

**KEYWORDS:** Isolation, vulnerability, jurisdiction, biodiversity data.

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Islands generally embody a sharp contrast between their wealth of biodiversity and their poverty in governance capability. On one hand, islands are places where Nature runs riot. On the other hand, such places often have little local fiscal or executive capacity to take measures that would protect such natural exuberance or allow for a sustainable tapping of its benefits.

Islands (including any surrounding coral reefs) have a disproportionately high number of endemic species. Madagascar has 8,000 endemic plants. The Philippines boasts more endemic vertebrates (460) than anywhere else on earth. The specific medicinal properties of particular island flora are known: many others are simply waiting to be acknowledged.

The sad corollary to this is that, due to the same high rate of endemism, islands are the sites where one is most likely to find the bulk of 12,259 plant and animal species facing varying risks of extinction. According to Gordon Grau, up to 75% of all the plant and animal extinctions ever recorded in the U.S.A. have occurred in the Hawaiian Islands. Indonesia has more species threatened with extinction than any other nation.

In the last 400 years, Duane Silverstein has calculated that 50% of all animal extinctions and 90% of all bird species extinctions have occurred on islands. Peter Bryant describes the unprecedented rate of species extinctions on islands as “one of the swiftest and most profound biological catastrophes” in the Earth’s history. Tiny Lord Howe Island has had more bird species and sub-species extinctions than Africa, Asia and Europe combined. Such a tragic scoreboard is also an outcome of islandness. Due to their self-contained nature, island ecosystems are liable to extreme damage caused by introduced species (such as feral swine in Hawaii or foxes in the Aleutians) by external contaminations (like oil spillages or crop diseases) or simply by human short-sightedness (deforestation, global warming, sea level rise). Why should this be allowed to happen?

I see such a tragedy as a measure of benign neglect and of underdeveloped jurisdiction. Islands are not always political entities, even though their discrete geography and isolation makes them ideal candidates for that. Around 100 island territories have some degree of sub-national autonomy, many others are municipalities or counties, and some 42 out of 193 islands are sovereign states. Were island populations equipped with stronger administrative or executive capacity of some kind, they may be better disposed to manage and protect such valuable species assets whose worth extends far beyond their shores. Island administrations would have a direct interest in preserving their unique biological capital, not just for environmental but also for commercial purposes (including patenting). They would have a direct interest in compiling island-specific databases and inventories. As things stand, the centres of power and decision-making that affect the bulk of the world’s islands may be too distant, physically and psychologically, to matter. Even island-specific data is hard to come by. Island development may have much more to do with local governance capability and subsidiarity.

**Knowledge Gaps:** Compiling and Profiling Island Specific Biodiversity Data (especially where islands do not have jurisdictional powers).

**Strategic Research Pursuits:** Bridging Biodiversity Research with Local Knowledge Appreciation and the Fostering of Local Governance Capability.

## Some notes on the Mediterranean Island Herpetofauna

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**Claudia Corti**, Department of Animal Biology and Genetics “Leo Pardi” University of Florence, Italy

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**SUMMARY:** The author looks at the human influence in the present distribution pattern of the Mediterranean Insular herpetofauna and the lacertid lizard fauna in particular.

**KEYWORDS:** Mediterranean Island herpetofauna, Lacertidae, distribution, biodiversity.

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Thousands of islands and islets are located within the Mediterranean basin. For example, if one considers the Greek islands alone, there are 9838 whereas the number of the Sardinian satellite islands amounts to more than 160 units.

The terrestrial herpetofauna is considered to be one of the main indicators of island faunistic population dynamics and of the relations with the continental faunas. In the whole Mediterranean region, the rate of endemism for herpetofauna is higher than for mammals (25%), corresponding to 56% of the amphibians and 62% of the reptiles.

If we look at the present terrestrial herpetofauna of the Mediterranean islands, we can still find several endemic elements, mainly represented by lacertid lizards.

Today the terrestrial herpetofauna of at least several of the Mediterranean islands displays a partially homogeneous composition of elements. It also consists of species that are more or less common to the present fauna of all the Mediterranean islands, and shows in part a generic continental origin influenced by the faunistic composition of the nearest mainland.

Strong and extended effect of human activity is one of the distinctive features of the present day Mediterranean faunas. As far as is presently known, this effect has acted since the beginning of the Neolithisation of the Mediterranean region, and starting in the Near East, involved geographical areas such as Cyprus, Crete and the Aegean islands in the course of the 8th-7th millennium BC, and extended westwards during the 6th millennium BC. Since those times many of the characteristic elements of the biogeography of the region have undergone a process of exploitation, which has continued into historical times. The voluntary and/or involuntary introduction of continental taxa has gradually replaced the autochthonous faunal elements, represented on the islands mainly by endemic forms.

In the light of what is mentioned above, there are several effects produced by man that acted on the present distribution of lizards in particular:

- colonisation and exploitation of habitats like agriculture, shipping and in more recent times the building of touristic areas;
- direct and indirect effects of habitat pollution, including the diffusion of diseases;
- the introduction of predators and allochthonous competitors, including domestic animals such as feral cats, mainly carried out in recent historical times;
- in the case of small populations, trade and collecting by amateurs could be particularly injurious.

The Mediterranean region is an important biogeographical “crossroad” and islands represent very important biodiversity reserves that are particularly rich in numbers of endemic lizard species.

Despite their taxonomic subspecific status it is important to point out the importance of the eco-ecological features developed over thousands of years on several small islands and islets.

Focusing our attention on the eco-ecological features of single island populations is the only way to recognise the real conservation strategies that must be employed, taking into account also for instance the interaction between lizard populations and other vertebrate species under protection.

The survival of all of them must be the ultimate goal of any future conservation strategy.

## **Canarian biodiversity under threat due to a non-sustainable development model**

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**José María Fernández-Palacios**, Ecology Department, La Laguna University, Spain

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**SUMMARY:** The outstanding Canarian biodiversity is in peril due to the non-sustainable economical development model based in the European mass tourism.

**KEYWORDS:** Canary Islands, hotspot, tourism.

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The Canarian archipelago is regarded as the region within the European Union with the highest biodiversity, with more than 18,000 (12,500 terrestrial and 5,500 marine) species in only 7,500 km<sup>2</sup>, from which ca. 3,800 species and 113 genera are endemic. Among them exist many explosive radiation examples deriving from a single founder event, both in fauna (such as *Laparocerus* weevils > 100 species) and flora (such as Crassulaceae succulent rosettes with 70 species). Furthermore, the Canarian species catalogue is still far to be completed, as shows the ratio of one new-for-science species discover each 5 days in the last 20 years, including three vertebrates (Teno and La Gomera giant lizards and the Canarian shrew) and two trees (the Grancanarian dragon-tree and the round-leaf fire tree). Due to these reasons the Canaries have been included, together with Madeira, in one of the 25 world's biodiversity hotspots, the Mediterranean Basin.

This panorama has given rise to the protection in two different webs (Red Canaria de Espacios Naturales Protegidos and E.U. Natura 2000 web) of almost a 45% of the Canarian territory, including 4 of the 12 Spanish National Parks (although the archipelago territory only accounts for a 1.5% of the state's area). Furthermore, there exist two different protected species catalogues, the Spanish one, protecting 200 Canarian species and the Canarian one, protecting 450 endemic species or Canarian populations of non-endemic species with a high emblematic value, like whales, dolphins or birds.

Nevertheless, the change experienced in 1960-1970 of the archipelago development model, shifting from an agricultural society to a destination of European mass tourism, has given rise to very abrupt socio-economical and cultural changes that are threatening our natural heritage. Today there are 12 million tourists visiting the Canaries each year, which, together with a population that increases 50-75,000 inhabitants a year due to immigration, lead to human population densities ca. 550 inhabitants/km<sup>2</sup> in Gran Canaria or 450 in Tenerife. This population needs increasing space for residence and infrastructure, energy –the clean energies accounting only for a 2% of the production–, food and water resources, and is simultaneously producing more wastes. This has led to a non-sustainable development, that has already destroyed and fragmented the coastal ecosystems, which have been substituted by buildings, harbours, roads and golf courses, as well as overexploiting the islands water table and the fisheries, whilst half of the agricultural area (50,000 has) is being abandoned. Today the pressure to the protected areas is increasing and several species former protected, included in the Canarian Catalogue Threatened Species, have been declassified in the last year. These facts project a dense shadow of uncertainty to the future of the largest European biodiversity heritage.

## Plant Biodiversity in Sardinia

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**Giuseppe Brundu**, Department of Botany and Plant Ecology, University of Sassari, Italy

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**SUMMARY:** The author charts the changes in biodiversity in the Mediterranean basin from early agro-pastoral systems to the recent and intense human driven land changes, reflecting on research priorities for the development of basic habitat management and plant conservation tools.

**KEYWORDS:** Agro-pastoral systems, fire, Sardinia, habitat management tools, metadata.

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For some millennia the vegetation of the Mediterranean basin has been subject to strong human impact and was profoundly modified by the degradation of the original forest cover and the extension of shrub communities and other physiognomic types. The agro-pastoral phase started approximately around 1,000 B.C: forests were partially destroyed and provided land for cultivation, pastures were stabilized through repeated burning, and marginal areas were occupied by shrubs. Fire is one of the most important factors influencing plant communities in the Mediterranean area and has had a tremendous impact in shaping or altering the vegetation and the landscape. For this reason, fire has become a subject of great interest in ecological studies, and we expect it has been a dominant environmental agent during the evolution of the Mediterranean flora. The effects of pastoral burning on vegetation are closely interwoven with those of grazing and cutting. An aggressive consumption of land along Mediterranean coasts, with a boom in building and a multiplication of tourist centers, occurred more intensively in the last 30-40 years, especially on islands, with negative impacts on habitats, native biodiversity and rare on endangered species. Nevertheless, the Mediterranean basin, although recently threatened by more intensive and diverse processes of human-driven land degradation, still provides an amazing and exiting ecological and evolutionary natural laboratory to investigate historical patterns of plant distribution, historical introductions and modern plant invasions, and mechanisms that generate species or inter-specific diversity.

Yet, from a certain point of view, and in comparison with other regions of the world, biogeographic and ecological studies in this region have somewhat lagged behind, only recently picking up speed. Sardinia (Italy), the second largest island of the Mediterranean with a surface area of about 24.090 km, lies in the middle of the Mediterranean basin, a kind of antithesis between focal interest and isolation that runs throughout the history of the formation of its actual flora. According to most recent botanical studies, the native flora of Sardinia is composed of slightly more than 2,000 taxa, with about 10% of endemic species, that is about 200 endemic species (some are exclusive of Sardinia, some are endemic of both Sardinia and Corsica). The total flora is enhanced by the presence of about 900 exotic species (archeophytes, neophytes, cryptophytes).

The taxonomic and scientific knowledge on endemic and native taxa in the Mediterranean basin is relatively well updated and continually in progress, yet there is still a lack of many basic tools for habitat management and plant conservation, highlighting a clear need for additional biogeographical and ecological studies, floristic distribution maps, localization and consistency of the endangered populations, studies and mapping of genetic structure and diversity of populations. This is mainly evident in the case of many islands, and in Sardinia in particular. Furthermore, available information on native and endemic taxa found on the islands and islets (as well as for non-native species) is still fragmented and frequently difficult to compare. Definition of common standards for metadata is another challenging task for future common research in the countries of the Mediterranean basin.

## **Island Biodiversity conservation: some research priorities**

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**Jorge Palmeirim**, Dept. Biologia Animal/Centro de Biologia Ambiental, Faculdade de Ciencias, Universidade de Lisboa, Lisbon, Portugal

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**SUMMARY:** The author discusses research priorities in terms of invasive species, the interface between native and matrix habitats, the implementation of action plans, and anthropogenic pressures.

**KEYWORDS:** Invasive species, native vegetation, action plans, conservation.

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The single most important threat to island biodiversity are probably invasive species, because the simplified animal and plant communities of islands seem to facilitate their overwhelming expansion. The devastating impact of some invasives, such as the replacement of native communities by continuous stands of exotic plants, is obvious. However, many spread discretely and their impact, even if serious and irreversible, may not be noticed without research. This is often the case of introduced predators, prey, seed dispersers, seed predators, etc. which can radically alter the food chains and the composition of the communities. While eliminating all exotic species may be an unrealistic goal, it is consensual that many must be controlled if we are to preserve insular biodiversity. However, there is still a critical lack of knowledge on the mechanisms that allow the expansion of exotics and on how to control them.

On some islands (e.g. in Macaronesia) there are patches of highly valuable native vegetation. These are often small “island within islands” and their long term survival is dependent on the capacity to resist invasion by species originating in the matrix of altered habitats. However, are birds carrying seeds of exotic plants into the native patches? Are exotic plants and invertebrates out-competing natives along the edges of the patches? Knowledge about what is occurring along the interface between native and matrix habitats is critical to plan conservation.

Some threatened endemic taxa (or communities) can only be saved with the implementation of specific action plans. However, much of the knowledge required for the preparation of those plans is missing. This includes the detection of the factors that are responsible for the decline of the taxa and the identification of the limiting factors that constrain their recovery.

On many islands space is often a limiting factor for both nature and Man, so conciliation between economic activities that occupy land and conservation is particularly important. Not all types of forest, agriculture, and urbanization are equally likely to result in habitats that support native species. However, we know little about how to make these man-made habitats more suitable for the preservation of threatened taxa, or for the maximization of biodiversity.

Finally, it is worth pointing out that much of the inter- and intra-species diversity made possible by island isolation is still uncharted. Some of this diversity may be lost before we become aware that it existed.

Considering the island conservation issues raised above I believe that the following should become research priorities:

1. Impact of invasive species on native communities and taxa;
2. Mechanisms that allow the spread of invasive species and methods to control them;
3. Ecological dynamics at the interface between valuable native habitat patches and the surrounding matrix;
4. Knowledge required for the preparation of species action plans for endemic species and communities, particularly about their limiting factors;
5. Agriculture and Forestry schemes that sustain native species.

## **Alien species and island biodiversity**

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**Patrick Schembri**, Department of Biology, University of Malta, Malta

I have been inspired to write this after reading the very interesting post from Jorge Palmeirim (Dept. Biologia Animal/Centro de Biologia Ambiental Faculdade de Ciencias, Universidade de Lisboa, Lisbon, Portugal) on research priorities concerning invasive species on islands, amongst other things. This is not a direct comment on the content of Jorge's posting, but more of a question or an invitation for comments.

Jorge mentions the case of some Macaronesian islands with patches of highly valuable native vegetation that need to be protected from invasive alien species. My question is how does one achieve this when there is little or no control of what is brought to the islands in the way of alien species that are potentially invasive if they are deliberately or accidentally released?

What has spurred this line of thought is the fact that my own country, Malta, is experiencing this very problem now that it has become a member of the European Union. Malta does not have as rich a biodiversity as do the Macaronesian islands, but it does have its own suite of scientifically interesting native species including island endemics. These are under threat from invasive alien species as are other islands biotas elsewhere. Before entry into the European Union, Malta operated a system of controls on the import of alien species whereby the importer had to apply for a permit to import BEFORE the actual importation took place. These permits were refused if the species was a known invasive in habitats similar to those that occur in the Maltese islands or if there was the danger that the species in question would negatively affect local biodiversity if it escaped or was released into the wild (applying the precautionary principle).

After 1st May, borders no longer existed between Malta and the rest of the EU and under the requirement of free trade anybody could bring in almost anything from any other EU member state. The system of requiring permits before transporting alien species to Malta was abolished. The result is that in the past few months there has been an influx of all manner of alien species into local garden centres, aquarium shops and pet shops and many more have been 'imported' by private individuals - these species include know invasives in Mediterranean ecosystems.

No know escapes have occurred so far, but very little time has passed and predicting that such an escape or release followed by establishment of an alien population in the wild is a pretty safe bet.

So again, how does one guard island biodiversity from alien invasive species under the 'free trade regime' operating in the European Union? How do existing EU member states guard their island biodiversity in this regard?

Perhaps one research priority can be the impact of existing management regimes on island biodiversity!

## **Taxonomy urgently needed for islands**

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**Cristian R. Altaba**, Laboratory of Human Systematics, University of the Balearic Islands, and Department of the Environment, Government of the Balearic Islands

Taxonomic knowledge of insular taxa is generally quite poor, and this is a major issue for conservation.

As an example, here in the Balearics, even after two centuries of natural history research, new species continue to be described. Botanists agree that many plants supposed to be conspecific with continental populations do look somewhat different -quite a few endemic plant species are recognized, yet it is clear that there are more awaiting careful comparative studies. Among reptiles, highly distinctive narrow-range endemics have traditionally been considered “subspecies”. The tradition for other taxa, such as land snails and birds heavily underestimated endemism, rarely reaching even subspecific status.

As a case in point, the Balearic shearwater was just recently recognized as a distinct species (more than enough evidence was there, yet it took years to convince fellow ornithologists!). This happened just in time to start urgent conservation action.

What might be happening in places barely explored? My feeling is that studies in systematics are really a keystone for conservation in islands, yet this central building block is still far from adequate to prevent widespread extinction.



## Consequences of biological invasions for plant-animal mutualisms in island ecosystems

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**Anna Traveset**, Institute of Mediterranean Advanced Studies, Spanish Research Council-University of the Balearic Islands, Mallorca, Spain

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**SUMMARY:** Biological invasions are a growing problem that threatens global biodiversity by dramatically altering both the structure and functioning of ecosystems. Most studies have focused on the impacts of invaders on species diversity and community composition, but only a small proportion have explored the mechanisms underlying such impacts. Moreover, invasive species have often been assumed to cause widespread extinctions, although good quality data supporting this are still scarce (Gurevitch and Padilla 2004). An impact that is increasingly receiving more attention is that of alien species on native mutualistic interactions between animals and plants, such as pollination or seed dispersal. Much information on the ecological consequences of pollination or dispersal disruptions due to biological invasions come from insular ecosystems, although an increasing number of studies also provide data from continental areas.

**KEYWORDS:** Invasions, pollination, seed dispersal.

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The introduction of an alien pollinator, in particular, may increase the rate of pollen exchange and, thus, positively influence plant reproductive success. However, introduced pollinators can also disrupt the plant pollination system and have a negative effect on plant fitness through different mechanisms: causing a lower seed set, decreasing pollen removal by efficient native pollinators (and thus paternal fitness), or simply promoting a lower gene flux. Evidence of such disruptions is found in islands such as New Zealand, Japan, Canary Islands, Hawaii, and Santa Cruz (California), where honeybees and/or bumblebees were introduced decades ago. Recent studies show that an introduced herbivore can also, directly or indirectly (by influencing the rate of pollinator visits to flowers), affect plant pollination success. Likewise, an introduced predator on the pollinators may also dramatically disrupt a native mutualism, as appears to have happened in New Zealand, where the introduction of rats, stoats, and opossums has led some species of pollinators (for instance the terrestrial bat *Mystacina tuberculata* (Webb and Kelly 1993)) almost to extinction. Finally, an invasive plant can disrupt a pollination mutualism if for instance pollinators have a preference for the alien and/or through a mechanism of interference between conspecific and heterospecific pollen on native stigmas. Unfortunately, we still have very little information on this, either from the continent (e.g. Brown et al. 2002) or from islands (Moragues and Traveset 2005).

Studies that examine the impact of invasive species on seed dispersal systems are still much scarcer. Alien animals that displace or prey upon native dispersers can also have an indirect influence on plant dispersal success. Documented examples come from the Canary Islands (Nogales and Medina 1996), New Zealand (Ladley and Kelly 1995; Spurr and Anderson 2004) and the Balearic Islands (Traveset and Riera 2005). Very little information still exists on how and how often alien plants compete for dispersers with native ones and on their effect on dispersal success of the native plants.

Further research in these specific areas of invasion biology is urgently needed to improve our ability to explain and therefore predict impacts of invasive species on biodiversity. Mutualistic interactions such as animal-mediated pollination and seed dispersal are among the most important processes that maintain and generate biodiversity. A major aim of conservation efforts should be to ensure the continued functioning of these processes. Part of the conservation strategies should therefore be to mitigate disruptions of such process brought about by invasive alien species.

## **The role of species attributes on invasion of Mediterranean islands by alien plants**

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**Francisco Lloret**, Centre for Ecological Research & Forestry Applications (CREAF), Unit of Ecology, Dept. of Animal and Plant Biology and Ecology, Universitat Autònoma de Barcelona, Spain.

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**SUMMARY:** The analysis of the biological attributes of alien flora of five Mediterranean islands shows the existence of biological attributes correlated to invasion success and the need for analysing large data sets in order to avoid local stochastic effects.

**KEYWORDS:** Alien plants, invasion, Mediterranean, islands.

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The recent increase of invasions of terrestrial ecosystems by alien plants has become a major consequence of human-induced global change. These invasions have a large potential to produce significant changes on native communities, with relevant impacts in the ecosystem services. Insular ecosystems are especially vulnerable to invasions, and specifically, the importance of alien invasions in Mediterranean-type ecosystems has been extensively documented.

The outcome of the invasion depends on the ecosystem invasibility, on the characteristics of the invading species, and on the introduction mode (i.e. propagule pressure). An important challenge for researchers has been to identify species traits correlated with the invasiveness of alien species. This approach, however, has several limitations. Geographical and historical particularities may determine idiosyncratic responses in different geographical areas. The relationship between attributes and invasion success may also differ among habitats. Finally, the sample size and the available information may be insufficient.

The analysis of the alien flora of five Mediterranean islands (Crete, Malta, Corsica, Sardinia and Majorca) have allowed to correlate the invasion success, estimated as an average of a semi-quantitative estimate of species abundance per island, to a set of fifteen vegetative and reproductive traits. Analyses were performed on groups of species defined by their affinity to semi-natural, agricultural and ruderal habitats. A well-defined set of traits constituting a global syndrome of invasion was not found, but five attributes were positively associated with alien success: vegetative propagation, large leaf size, summer flowering, long flowering period, and dispersal by wind or vertebrates. When analysing for individual islands, fewer significant attributes were associated with success, that is, we found that the relation between attributes and success was often island specific. Given the stochastic nature of exotic species assemblages on the islands, the study highlights the importance of estimating invasion success across a wide region and a variety of habitats thus minimizing local idiosyncrasies.

## Biodiversity issues in the Azores

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**Paulo Borges**, University of the Azores, Portugal

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**SUMMARY:** The author describes a project studying patterns of arthropod diversity in the Azores, and links with wider biodiversity conservation.

**KEYWORDS:** Azores, biodiversity, species richness, Natura 2000, ecosystem change.

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Conservation of Island biodiversity is of great relevance for the conservation of an important component of world biodiversity, made of uniquely evolved biota. In the last 6 years I studied with other colleagues patterns of arthropod diversity in a remote and geologically recent archipelago, the Azores (Project BALA - "Biodiversity of Arthropods from Laurisilva of Azores"; [http://www.nrel.colostate.edu/IBOY/europe\\_ap.html#BALA](http://www.nrel.colostate.edu/IBOY/europe_ap.html#BALA)) (Borges et al., 2000). I showed the importance of evolutionary processes, the diversity of endemic species on a given island of the Azorean archipelago being a function of the geologic age of the island (Borges & Brown, 1999). However, habitat diversity and area also play a role in explaining overall species richness, as showed by recent studies performed in arthropod diversity from the soil and the canopies of Azorean endemic trees (Borges et al., in prep.). Most canopy phytophagous insects are generalists (Ribeiro et al., in press) and composed of more than 50% of endemics. The lack of native ants, the dominance of spiders and the poverty of beetles in tree canopies make the canopy highly disharmonic and unique.

When evaluating the factors that explain spatial patterns of species richness of soil epigeal endemic and introduced arthropods we showed recently (Borges et al. *subm.*) that abiotic (climatic and geomorphological) variables explained more of the variation in endemic species richness, whereas anthropogenic variables explained most of the variation in introduced species richness. There is an evidence of a somewhat inverse spatial distribution between a group of oceanic-type forest-dwelling endemic relict arthropods and a group of more generalist endemic arthropods that are able to survive in disturbed marginal sites particularly rich in non-indigenous species. Richness of endemic species is driven by abiotic factors such as a climatic axis (oceanic-type localities with lower temperatures and summer precipitations) and a binary variable CALD (location of sites in calderas or ravines), whereas richness of introduced species depends on disturbance related factors. Our results show that there is the danger of replacement of restricted specialized arthropod forest dwelling endemics by endemic generalist grassland arthropods, causing in future a spatial similarity of endemic arthropod faunal composition within the island. This pattern of biotic homogenization with endemic taxa is novel and was never described.

We also are concerned by the fact that two areas not included in the NATURA 2000 framework were considered of high priority using several reserve selection procedures, indicating that vascular plants and bird species used to determine NATURA 2000 sites are not good surrogates of arthropod diversity in the Azores (Borges et al., in press). The most irreplaceable reserves are those located in older islands, which indicates that geological history plays an important role in explaining faunal diversity of arthropods in the Azores (see also Borges & Brown, 1999).

Of key importance is the evaluation of drivers of future island ecosystem change, both at local and regional scales. I suggest that the impact on island biodiversity of the following drivers should be carefully evaluated: land tenure and farm structure; economic growth; land use changes; volcanism; tourism; exotic species spread; environmental legislation and attitudes; EU Common Agricultural Policy. The interaction between these drivers should also be evaluated, mainly when comparing the impacts of agriculture extensification versus agriculture intensification in island biodiversity.

## Social aspects of biodiversity policy in the Mediterranean

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**Douglas Bardsley**, School of Anthropology, Geography and Environmental Studies, University of Melbourne, Victoria, Australia

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**SUMMARY:** For effective management of invasive species on the Mediterranean islands it is necessary to determine the most detrimental invasive species within both the local ecological and social contexts and focus activities on those most noxious species.

**KEYWORDS:** Invasive species, Mediterranean, EU environmental policy.

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While invasive species have negative impacts on ecological and social systems, it is important to remember that there are enormous benefits derived from exotic species (Williams, 1997; Kendle and Rose, 2000; Hettinger, 2001, Pimental et al. 2001, Baskin 2002). Developing trade and tourism throughout the European Union (EU) will increase the number and range of exotic introductions across the Mediterranean islands (Bright 1999, Jenkins 1999). While an improvement in the ecological knowledge of invasive species is necessary, an enhanced understanding of the associated social processes is also required to develop effective management approaches (DiTomaso, 2000, Grosholz, 2002). As part of the EPIDEMIE study, stakeholders' perceptions of the impacts of invasive plant species on Mallorca, Sardinia and Crete were examined (see acknowledgements).

Invasive exotic species management will need to aim for socio-economic, as well as ecological sustainability. The IUCN defines exotic species as those species occurring outside their normal distribution (Shine et al., 2000). Yet, is it possible to perceive of a natural ecological state on the islands of the Mediterranean? Numerous stakeholders stated that they consider the naturalisation of exotic species to be part of an ongoing process of environmental change on the islands. In other words, a sense of place is linked with the processes of cultural and ecological change associated with many invasive species (Stedman 2003). For example, the yellow flowering *Oxalis pes-caprae*, introduced from South Africa in the Nineteenth century, is widely considered to be an attractive, native species (Damanakis, 1976; Marshall, 1987).

Perhaps issues of invasivity should be considered differently within the context of Old World or New World ecological conditions. The Old World, through the necessity of continuous human occupation, must respond in a comprehensive strategic manner, rather than simply excluding species and their impacts from perceived natural sites. For example, beyond specific blacklisted organisms, there appears to be no socio-economic justification for the application of stringent quarantine mechanisms to control the importation or utilisation of potentially invasive species in the Mediterranean region (Humphries et al., 1991; Shine et al., 2000). When asked about quarantine restrictions an Italian customs official (19/02/2002) described the situation succinctly: 'in a country like Italy, the problem of exchange of organisms is not felt like in Australia, because people have taken things in and out for at least 6000 years', and continued, 'Australia is like a child that can catch everything, here we are old, we are immune to everything.' It could be argued that Mediterranean environments should continue to evolve within the changing cultural landscapes as they have for millennia. However, recent introductions represent a global exchange of species of a scope that is cosmopolitan in nature and of a scale that is unprecedented in human ecological history (Edwards, 1998; Kendle and Rose, 2000; Mack et al., 2000; McNeely, 2000).

As the EU develops and integrates environmental policy across the Mediterranean region, there are some important messages emerging from the research (Bromley, 1997; Kousis and Lekakis, 2001). To achieve local support, it is vital that environmental scientists do not malign all potentially invasive species, but rather, focus on those species that are the cause of major, recognised negative social and ecological impacts (Cronk and Fuller, 2001). Edwards (1998), DiTomaso (2000), McNeely et al. (2001), and Wittenberg and Cock (2001) suggest that holistic plans should carefully target species or ecosystems, and attempt to integrate mechanical, cultural, biological, and chemical management techniques. The

protection of significant natural areas remains important for biodiversity management and the management of *Carpobrotus* spp. in coastal ecosystems on Mallorca provides a good example of such activities (Médail and Quézel 1997, Lavorel, 1999; Prieur-Richard and Lavorel, 2000). Beyond these exceptions, policies must acknowledge the Mediterranean island ecosystems are both anthropogenic and environmental constructions (Grove and Rackham 2001).

There is an ongoing role for state institutions to govern this complex environmental issue, because many stakeholders recognise that they are insufficiently trained or informed to make effective management decisions. However, to prevent hostile responses from agricultural producers, nursery owners and other local residents, it will be necessary to research and evolve invasive species management approaches with substantial local input. Detailed research can determine the most detrimental invasive species within local ecological and social contexts, and propose methods of actively managing them while raising awareness of their impacts on the islands.

Many thanks to stakeholders on the islands of Mallorca, Sardinia and Crete for their time and to Professor Neal Enright for reading through this paper. This address draws from a study that is part of EPIDEMIE (Exotic Plant Invasions: Deleterious Effects on Mediterranean Island Ecosystems), a research project supported by the European Commission under the 5th Framework, contributing to the implementation of Key Action 2.2.1 (Ecosystem Vulnerability) within the Energy, Environment and Sustainable Development thematic programme (Contract no. EVK2-CT-2000-00074). Further details of the project can be found at [www.Centre for Ecology and Hydrology.ac.uk/epidemie](http://www.Centre for Ecology and Hydrology.ac.uk/epidemie)

## **Assessing the ecological state of the Mediterranean: a need for baseline monitoring**

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**Phil Lambdon**, Island Biodiversity session chair, Centre for Ecology and Hydrology, Banchory, UK

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**SUMMARY:** Islands are potentially very sensitive indicators of global change, and enhanced monitoring protocols are needed to examine the large-scale trends in the distribution biological communities. Problems facing the Mediterranean are highlighted, and the potential use of mapping projects proposed as a means of auditing the state of the environment is discussed.

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Islands are valuable “barometers” of global change, where many issues global of concern are experienced with particular severity. This is partly as a result of their position, which makes them sensitive to changes in the climate, partly due to their small size and partly to isolation. Small territories which are often exotic and attractive to visitors are vulnerable to human pressures, and may become rapidly overcrowded. Their ecosystems are often fragile, and since they represent almost “closed” systems with little metapopulation flow from outside, should be especially sensitive to habitat fragmentation.

Although close-monitoring of islands could potentially be particularly informative of the effects of global change, they often remain neglected. The regions are frequently poor and do not have the strong culture of ecological research which has developed in some parts of the world. One such area at risk is the Mediterranean, where despite relatively developed societies, there remains insufficient knowledge of biodiversity to assess large-scale impacts over time. Here, I outline some of the key issues of concern for the region, and the need for baseline data before we can estimate the scale of the problems.

Islands of the Mediterranean are currently exposed to a number of environmental threats associated with modern society, driven particularly by the boom in the tourist industry. This lead primarily to a dramatic development of coastal regions over the last 30 years, resulting in urban spread and direct land use conflicts over some ecologically-sensitive areas.

Other associated problems have developing with this change are as, or more, severe in their impacts:

Demands for water have lead to increased abstraction, resulting in potential crises around cities such as Irakleon, Crete, in climates, which are already very dry in summer.

Increased traffic has lead to many more alien introductions, and the need for landscaping around touristic areas encourages the widespread planting of non-native species, often with little regard for their potential invasiveness. As a result, many competitive, dominant aliens are creeping into native habitats.

The lure of wealth around coastal areas has exacerbated the rate of rural depopulation, with the result that traditional land use has fallen into neglect to be replaced by less varied forms of management. On Crete, large areas have been converted to olive groves, growing the industry from around 11 million trees in the early 1980s to over 25 million today. Much of this monoculture remains under low-intensity management, which partly offsets the tendency elsewhere for agricultural improvement and a rise in the use of harmful pesticides. However, more business-orientated practices are now beginning to be adopted. Also, biological pollutants such as the alien weed *Oxalis pes-caprae* (Bermuda buttercup), which survives particularly well under the canopy of olive trees, have all but wiped-out much of the arable flora, for which the Mediterranean is so well-known, in many areas.

An increased desire to maximize profits from the land, with a smaller manpower, has resulted in a dramatic increase in livestock numbers on common range. On Rhodos, the recently-adopted practice of supplementary feeding during the dry season has greatly increased the carrying capacity of these areas. Much of the Aegean is covered by arid shrublands which are becoming increasingly degraded by overgrazing, and regeneration to natural woodlands has all but ceased. The effects on biodiversity have been poorly-studied.

The impact of tourism is compounded by the fact that it is mainly catering to exogenous interests. The pressures to develop are not imposed by local people who have a vested interest in protecting their environment.

In view of these concerns, it is imperative from a scientific point of view that changes are assessed and their impacts monitored. Although some data has been compiled, such as the Red Lists and Natura 2000 surveys, we do not know how many species are at risk across many taxa and lack detailed information on their broad-scale distribution, which is necessary in order to detect range increases or decreases. Until this baseline data is available no resurvey will be possible, so the establishment of basic protocols is an immediate priority. One example of how useful such datasets may be has arisen from another island system (albeit a large one), Great Britain, where the recently published New Atlas of the British Flora (Preston, Pearman & Dines, 2002) has been able to compare the current state of higher plant distributions with an earlier survey conducted in the 1960s. These analyses have shown a decline amongst many species of upland and nutrient-poor communities at the expense of anthropogenic and eutrophilic competitors. Alien invaders have shown substantial advances and many traditional agricultural weeds are in alarming decline.

A similar system of broad-scale surveys across selected islands in the Mediterranean could serve as valuable network for global change monitoring in the future. As in the UK case, such an undertaking could be achieved efficiently by using local expertise. There are well-developed ecological networks on the Balearics, and the general taxonomic biodiversity (of the flora at least) has been well-documented by amateurs in many regions, thus providing a useful starting-point for a dedicated project. To date, few island floras have been mapped in any detail. Although Crete has a flora that includes distribution maps (Turland, Chilton & Press, 1993), these are still somewhat provisional for many species. A recent survey as part of an EU project EPIDEMIE ([www.Centre for Ecology and Hydrology.ac.uk/EPIDEMIE](http://www.Centre for Ecology and Hydrology.ac.uk/EPIDEMIE)) has assessed the distributions of alien invasive species on eight islands including Crete, and already detected dramatically considerably expanded ranges on this island than were previously recorded (although this may be partly an artefact of recorder effort). To examine critical changes to native flora, similar enterprises are needed.

## **Island Biodiversity questions**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

Imagine that you are the co-ordinator of a biodiversity project in the theme of this discussion. Your consortium, composed of some excellent teams from all across Europe and from countries outside Europe, includes social and natural scientists and economists. You have received a grant of 10 million.

What is the question, or what are the questions, that you and your consortium are trying to answer?

Can you phrase it in just a few words: Is there life on Mars? How do marsupials keep their pouches clean? Do cell-phones fry your brains? How much plant life is needed to keep a person alive in a sealed room? Can humanity survive?

## **Question to answer**

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**Paulo Borges**, University of the Azores, Portugal

Martin Sharman asks, “What is the question, or what are the questions, that a Biodiversity consortium should try to answer?”

In my opinion the Biodiversity Research Agenda should be:

- Which species-area models should be used to predict species extinctions in both native and Human -made habitats;
- What is the contribution of Human-made habitats for the conservation of biodiversity?;
- What is the impact on Biodiversity of the following drivers: land tenure and farm structure; economic growth; land use changes; volcanism; tourism; exotic species spread; environmental legislation and public attitudes; EU Common Agricultural Policy.
- What is the impact of spatial patterns (local vs. regional) of species distribution, abundance and richness on species conservation;
- How to solve the exotic species invasions on islands;

## **Sustainable management of insular biodiversity**

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**Philippe Feldmann**, CIRAD, Montpellier, France

Not as far as Mars but not always so well known, Europe has a unique situation to develop major biodiversity research projects with its 30 “outermost” regions and territories (also called RUP and PTOM), mainly islands located in several oceans and continents of the planet. They include tropical, subtropical, temperate, arctic and sub-arctic, Antarctic and sub-Antarctic areas and are located in major hotspots of terrestrial or marine biodiversity, making Europe one of the major entity in terms of biodiversity and endemism, and with a very high responsibility.

What a good opportunity to understand how the factors of biodiversity evolution in islands will help us anticipate the consequences of major global changes linked to human activities!

Understanding the interactions between their ecosystems and human activities can provide the essential knowledge to ensure sustainable development. Above all, it is necessary to 1) Model, evaluate and anticipate the consequences on insular biodiversity of major global changes linked to human activities; use these models to anticipate possible evolutions in other environments; 2) Develop tools and methods to achieve sustainable biodiversity management in close relation with local populations.

This subject will be submitted to debate for a workshop entitled Sustainable management in tropical and sub-tropical islands during the international conference



Biodiversity: science and governance that will be held in Paris from January 24 to January 28, 2005: <http://www.recherche.gouv.fr/biodiv2005paris/en/index.htm>

**RE: Island Biodiversity questions**

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**Jose-Maria Fernandez-Palacios** Department of Ecology, Faculty of Biology, Universidad de La Laguna, Spain

This is my guess: How can we calculate the sustainable carrying capacity of an island?

**RE: Island Biodiversity questions**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

It's easy. The first question, the general question on biodiversity is: how many species are there on earth? Yes, we do not know.

Another one might be: how many species names are correctly given, in other words, behind each name is there really one species or are there more, or less (the problem of synonymies)?

Here's another one: are rare species endangered? Or: is being represented by few individuals invariably a sign of low health for a species? The species present on islands are usually represented by few individuals in respect to those on continents...

- What are the main centres of biodiversity on the planet? (in this question I am not speaking just of the obvious species, I refer to ALL biodiversity, but the 10 million grant is not enough)

- What is the role of islands in enhancing biodiversity?

- Do islands re-distribute the biodiversity they contribute to form?

- Does island biogeography apply also to the marine environment?

- What is the percentage of endemics in all islands of the planet?

I can go on like that for many pages. Just another one:

How many scientists are able to recognise a new species if they kick one? I know the answer: less and less.

Note: most of these questions require A LOT of money to be answered. More than 10 million. Strange enough they are unanswered. It is suggestive that Martin came out with a question on life on Mars. We actually spent more, much more than 10 millions to answer this irrelevant question. What will change in our everyday life if we know that there is a life form on Mars? Nothing. And there is not. The questions I made above, especially the first one, are of vital importance for our well being, as the Rio convention acknowledged, but then the resources go to the search of little green men. Or to the Hubble telescope, so we can say that there is another galaxy out there. Biodiversity research, in comparison, receives peanuts. We have the right questions. How comes that we are so interested to discover if there is life out there and we are not so interested in the life down here? It is irrational. I know that the neighbour's grass is always greener than yours, but governments should act in a more rational way. Of course I know the reason: the guys who make rockets are powerful. The guys who recognise species are worthless. So, OK, let's play this game. But I do not hope that somebody will say, wow, these are nice questions, let's invest our money in them and stop financing a scientific project that has required billions for decades and never yielded a single positive datum (the search for life outside our planet). Let's face it: we are not influent enough.

## **RE: Island Biodiversity questions**

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**Felix Rauschmayer**, UFZ, Leipzig-Halle, Germany

Strangely enough, nobody seems really to integrate social scientists in his research...

Perhaps “close relation with local populations” could be a matter for social scientists (or for PR managers?)...

Questions from this domain could be:

- Why do people like or dislike exotic species? Do they think that their (dis) like should influence the policy?
- Which possibilities for measures against exotic species are there really? (i.e. taking into account budget constraints, continuing globalisation, CAP, etc)
- How important is biodiversity change due to biological invasions for people in relation to less trade and less tourism?
- Do they consider future human generations when answering this question? Why (how) or why not?

## **RE: Island Biodiversity questions**

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**Phil Lambdon**, Island Biodiversity session chair, Centre for Ecology and Hydrology, Banchory, UK

Ferdinandino Boero is quite right in his assertion that biodiversity can be an expensive business. Any funding available to us will only ever scratch the surface. To be a little cynical, it will certainly never be enough to do what is needed.

With this said, we have to make the best of a bad job, which means being ultra-efficient with the money available. Questions can fall into three categories: (1) How much biodiversity do we have? (2) How will it be affected by change? (3) How should we manage it?

More questions...

Which of these should we focus on? Can we justify biological surveys when there are already pressing management problems to address? Can we look at management issues effectively if we don't know what is there, or how it responds to the environment?

## **RE: Island Biodiversity questions**

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**Robert Kenward**, Centre for Ecology and Hydrology and IUCN European Sustainable Use Specialist Group

To complement (and to an extent overlap) the useful previous questions by Tim Kitchin, Erling Berge and especially Jan Jansen and Jeff McNeely, my questions would be:

1. How best (ecologically and socio-economically) to integrate use of protected areas, creation of connecting ecological networks and yield-reduction offset strategies in the surrounding intensive-use matrix for restoring biodiversity at all levels? (NB yield-loss-reduction offset strategies would include pay-for-use as well as redirected CAP).
2. How to get the most cost-effective restoration of terrestrial biodiversity at local levels, from all available ways of using wild resources? (NB not just from trade and tourism, but in all categories that can be localised or remote, including watching, collecting, fishing, hunting, etc, whether recreational or commercial, and using volunteer efforts as well as direct or indirect payments).

3. What drivers and instruments at higher level can be most cost-effectively changed to facilitate efforts at local level?

**RE: Island Biodiversity questions**

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**Emmanuel Koutrakis**, Fisheries Research Institute, National Agricultural Research Foundation, Kavala, Greece

Once again Ferdinando astonished us with simple explanations that of course we know, of course are simple, but then why the situation continues to go like this?

But it is not only the industries that make rockets and guns (they are usually the same) and in this way economies of big countries go on, it is also the necessity of humans, which of course is also used by politicians for their countries, to say that “we arrived first!!” to the top of the mountain, to the North Pole, to space, to the moon!!!

We could promote a new competition: “Which country/area/island has more biodiversity of each category!!” or something similar that also could be used by politicians.

Maybe in this way we could fruit to learn more for our planet!!

**RE: Island Biodiversity questions**

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**Phil Lambdon**, Island Biodiversity session chair, Centre for Ecology and Hydrology, Banchory, UK

Supply and demand in pure studies around biodiversity (leaving aside issues of management and social questions) is delicately balanced. A suitable approach necessitates a “food pyramid” of researchers. At the bottom level are the ground-level taxonomic and field-based studies. System based-modellers need a few of these each to survive; database compilers must rely on a large number of sources and comparative metadata studies even more.

The economics of funding policy operates under different pressures. Here, it is more important to keep the maximum number of scientists employed for a given amount of money. This is best achieved through a larger number of cheaper projects, which tends to favour desk-based modelling and database work. These also produce papers quickly, which is good news for publication records.

Having worked with databases recently, it seems to me that there is not enough basic biological data to sustain many studies at this higher “trophic level”. Pressure to get funding means that proposals may sound good in theory, but ultimately it is becoming increasingly difficult to obtain convincing patterns with a limited amount of information, which may also be of varying quality.

To complete the analogy, I feel that it would be good to have more “plankton” and fewer “sharks”.

**RE: Island Biodiversity questions**

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**Franz Uiblein**, Institute of Marine Research, Department of Marine Resources, Bergen, Norway

How and to which extent do humans interact with biodiversity on and around islands? Do biodiversity and ecosystem parameters reveal specific responses and adaptations to constraints arising from long-term natural settings (e.g., isolation, living space, ocean-land interconnectedness) and human-derived influences (e.g., invasive species, habitat destruction and modification, fisheries, pollution, mass tourism)? What are the specific needs of local island communities and of those coming from outside? Can these requirements be adjusted to

sustainable levels considering both the constraints and the values of island biodiversity maintenance?

## **Capacity building for conservation**

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**Douglas Bardsley**, School of Anthropology, Geography and Environmental Studies, University of Melbourne, Victoria, Australia

I am currently examining methods of developing local capacity amongst landholders for biodiversity conservation in the Mediterranean climates of South Australia. The question of how ecologists can best inform and assist stakeholders to conserve biodiversity is open to debate and seems to be a much needed area of research.

Does anyone know of highly successful examples, from the European context, where ecologists have worked with farmers to develop local capacity for sustained biodiversity conservation outcomes?

## **Recent marine extinctions**

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**Nicholas K. Dulvy**, Centre for Environment, Fisheries, Aquaculture Sciences, Lowestoft, Suffolk, UK

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**SUMMARY:** Here I review human impacts on the oceans and outline evidence for local, regional and global marine extinctions over the past 300 years.

**KEYWORDS:** Fishing, habitat loss, extinction.

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Human impacts on the oceans are widespread and substantial and concern has been growing of the possibility of extinction of marine species. Fisheries exploitation has removed a high proportion of the abundance and biomass of species at the top of marine food chains and benthic disturbance of fishing gears has caused some degree of habitat degradation. Fishing also removes non-targeted species, including birds, aquatic mammals, reptiles, sharks and rays and other fishes and invertebrates. Habitat loss is a major cause of modern extinctions of mammals, birds, butterflies and plant on land; by comparison little is known of the extent of or the rate of change of major marine habitats. The only habitat for which loss rates are known at large spatial scales is coral reef, and recent estimates from the Caribbean and the Great Barrier Reef indicate a decline in hard coral cover of approximately 1% per year over the past 25 years. Finally, the occurrence of novel marine pathogens appears to be on the increase and diseases are associated with mass mortalities of a number of marine species.

Current evidence suggests few marine organisms have become globally extinct in the past 300 years, compared to on land where 100s of birds and mammals have disappeared. There is unequivocal evidence for the extinction of only three marine mammals, five birds and four gastropods. Another 18 taxa could be considered extinct if their status as a valid species can be confirmed. Most of these species were large bodied and presumably had low maximum population growth rates and little capacity to withstand the hunting pressures they were exposed to. It appears the gastropods were habitat specialists, and disappeared as a result of habitat loss. Three diadromous fishes have been exploited to extinction (New Zealand grayling, Adriatic beluga and Aral sea ship sturgeon). By contrast there is little good evidence for the global extinction of fully marine species. Though there are hints that Galapagos damselfish and the Mauritius green wrasse have become extinct throughout their small geographic ranges. If the definition of extinction is relaxed to consider local and regional disappearances then the list is much longer. It is estimated that a total of 133 marine species have undergone a local, regional or global extinction. Given the relatively high degree of fishing impact on marine fishes this could be interpreted to suggest the effect on fish biodiversity has been low. This would be consistent with arguments that marine organisms are more resilient to extinction and more able to recover than terrestrial species due to larger geographic ranges, wide larval dispersal and higher fecundity. Alternatively it could be that it is more difficult to detect extinctions of non-air breathing marine organisms. The latter hypothesis cannot be discounted for three reasons: most local and regional extinctions were detected retrospectively long after the date of last sighting, most (80%) were detected using retrospective methods and even the best marine monitoring surveys have very little power to detect declines and disappearances. If knowledge of marine extinctions were perfect there would be little time lag between the date of last sighting and reported date of disappearance. However there is typically a 53-year reporting lag. In summary, current evidence is consistent with the hypothesis that the number of marine extinctions is underestimated.

## **RE: Recent marine extinctions**

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**Syed Mahmood Nasir**

I hope all these species are listed in CITES appendices.

## **Fiji island coral biodiversity and fishing**

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**Nicholas K. Dulvy**, Centre for Environment, Fisheries, Aquaculture Sciences, Lowestoft, Suffolk, UK

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**SUMMARY:** Here I review the effects of fishing on coral reef biodiversity based on island scale studies in Fiji.

**KEYWORDS:** Fishing, predator, outbreak, extinction

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Fishing precedes all other impacts on coral reefs yet the impacts of fishing are extremely difficult to detect on coral reefs. This is largely due to a lack of capacity to gather the kind of time-series of fishing activity and ecological information at appropriately large spatial scales. Even well resourced coral reef countries, like Australia and US territories, have little idea of the temporal and spatial extent of fishing on their coral reefs. Consequently it has almost been impossible to gauge the true impact of fishing on coral reefs at appropriately large spatial scales. Fiji offers a unique opportunity to study the effect of fishing on coral reef ecosystems. Fiji has marine tenure - villagers own parts of the sea in the same way that farmers own fields of land. Only resident villagers, or occasionally licensed outsiders, can fish the local fishing ground. More often than not each island reef comprises one single fishing ground, isolated from other fishing grounds (islands) by tens of kilometres, almost excluding the possibility of poaching. While other countries may have marine tenure, only in Fiji has it been systematically documented. Fijian fishing grounds or qoliqoli were mapped during the British colonial administration.

Early work in Fijian fishing grounds established that higher human densities per unit of coral reef were associated with higher overall fishing activity and higher levels of extraction. So multiple islands, each varying in number of inhabitants and coral reef area, can be used as replicate units along a spatial gradient of fishing intensity (people per unit area of coral reef). Fish were captured using non-habitat destructive methods such as spears and hook and line for subsistence consumption - there was little opportunity to store sell or trade fish. The levels of subsistence fishing in these islands are among the lowest documented in the world. Overall a relatively small proportion of the standing stock is removed, typically <5% annually, however, even such low levels of harvest have profound effect on community structure. Up to 60% of the biomass of the largest size classes is removed by exploitation. The biomass of smaller fish size classes has increased by 30%. The mean size of fish declined by half and the representation of large species declined along the spatial gradient, as larger species are intrinsically more vulnerable to exploitation than their smaller relatives. Richness of predators, mainly groupers and snappers, was lower at grounds with higher fishing intensities. However, as far as we can tell, there has only been one local extinction due to fishing - of a large bumphead parrotfish. The depletion of larger predatory size classes of the fish assemblages has cascading effects throughout the ecosystem. Evidence suggests that removal of predatory fishes has resulted in outbreaks of a coral-eating starfish. These starfish outbreaks have occurred only at fishing grounds with lowest predatory fish densities and highest fishing pressures. The outbreaks have caused mass coral mortality and the dead corals were subsequently colonised by algae. Consequently fishing has resulted in repeated 'ecosystem meltdown' from hard coral dominated 'calcifying' ecosystems at lightly fished islands to algal dominated 'non-calcifying' ecosystems at most heavily fished islands. These Fijian studies caution that even low levels of predator removal have potentially negative effects on coral reef biodiversity and ecosystem function.

## **Ecological modelling as a tool for upgrading conservation**

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**Antonios Mazaris and Yiannis Matsinos**, University of the Aegean, Lesbos, Greece

One of the most important priorities of biodiversity research in insular systems deals with the conservation of endangered species. Apart from the endangered species of the flora and fauna endemic to the interior of the island, of paramount importance are migratory species that use this terrestrial habitat for limited time during their movements. In the case of marine turtles that spend most of their life span in the water, nesting and reproduction are the only life history stages that occur in the coastal zone. It is apparent that the interaction of marine turtles with their nesting environment has a multidimensional character covering an array of natural processes (Miller, 1997). Loss of suitable nesting areas due to fragmentation, reduction of the size of the nesting sites due to geomorphologic and topographic changes but also changes in vegetation structure due to disturbances (e.g. fires), soil erosion, sediment flows, etc, could have direct or indirect effects on marine turtle population dynamics.

Our experience stems from the study of the endangered loggerhead turtle *Caretta caretta* nesting in the island of Zakynthos, West Greece. The island represents the most important nesting colony of the species in the Mediterranean Sea, supporting the largest number of nests laid per breeding season. From the accidental discovery of the species three decades ago until our days, a series of studies first based on observation (counts) and recently combined with theory in terms of models were conducted. The role of modelling in assessing population trends in conservation ecology has been well documented. Although the scarcity of parameters can sometimes be a limiting factor, the insight gained from models can be of high conservation value. For example, the use of a modelling platform recently developed for the Great Barrier Reef showed the applicability of computer modelling in real conservation by emphasizing the timely implementation of model suggestions (for wider audience review see New York Times, 21/9/04).

With respect to our target / study species and taking into consideration the dynamic of global and local scale's natural and human induced processes, readjustment and improvement of conservation measures is considered necessary. Investigation of the interaction between environmental attributes and species demographics characteristics through models could significantly improve conservation. Modelling studies undertaken on this field provide some first insights on critical life stages investigating their relative importance upon population persistence (Chaloupka, 2002, Heppell et al., 2004). While a better understanding of interactions among climatic factors, animals' distribution and breeding performance were found to be a key feature of exploring dynamics of the population (Mazaris et al. 2004).

Given the high importance of direct conservation readjustment, implementation and action, the need for filling the gap of our knowledge becomes exigency. An integrated research framework comprised studies on both theoretical and practical basis are strongly required, while application of advanced new technologies (i.e. remote sensing, GIS) should be applied in a wide spectrum. Environmental monitoring of natural processes, mapping critical habitats (in the case of marine turtle nesting areas, or feeding grounds), research on navigation and also migration movements could be used for the development of dynamics data bases, allowing the analysis of environmental and ecological changes in a temporal and spatial scale. Additionally efficient conservation measures applied on such marine species, their coastal habitats and insular systems require upgraded techniques highlighting the need for multi regional and intergovernmental cooperation. For improving our knowledge and implementing efficient conservation, combinational research and cooperation is required.



## Sacred islands

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**Scott Jones**, Centre for International Development and Training, University of Wolverhampton, UK

I wonder what scope exists for considering island canopies, or islands of biodiversity associated with sacred places. In Africa, for example, churchyards, cemeteries or large trees holding religious significance provide islands of biological diversity from sub-soil to canopy and beyond.

The physical, chemical and biological attributes of soils, the diversity of the herb and shrub layer, and the complex biology and architecture of larger perennials differ markedly from the “sea” of agriculture or degraded grazing lands around them. Working in ecological restoration, I have used soil inoculum and seeds from sacred places. In Eritrea, we have also been trying to understand the implications of genetic diversity within and among sacred “canopy islands” especially related to rapidly disappearing tree species where sacred places form the only remnants of afro-montane forest.

Sometimes there are very large expanses of land between individual trees or a cemetery or churchyard where there may be 30 or 40 trees. Poicephalus parrots and other birds fly between these without stopping (nothing to stop on), and I assume insect ecologists would join the bird folks in recognising the importance of sacred island canopies for feeding, roosting or nesting. (Do insects roost?)

Not much research going on in these places - but they definitely have many island characteristics.

I suspect that sacred buildings and cemeteries elsewhere, in less degraded areas than semi-arid highland Africa, also have special associations of plants and animals that are different from their surroundings but have much in common with each other. These also might be reflected in soil characteristics. Additionally, these thoughts raises questions about the spiritual aspects of biodiversity that many people hold dear in different societies across the world.

Finally, working as a social scientist as well as ecologist in natural resources conflict management, I was struck in the South Pacific about how many island communities have different approaches to problem solving that often relate to biodiversity-related conflicts (or can be related to them). Island biodiversity is a useful concept for conflict management (noting also some of the comments of Barbara Gray in another section of this conference). Not enough space here to go on with that - but would welcome a debate about diversity in relation to NR conflict management.

And finally, finally, what about sub-aqua islands? If one thinks of coral reef degradation (e.g. Crown of Thorns and other causes), what possibilities exist for thinking about islands of biodiversity under the water. Do these share some of the biodiversity, dispersal, and other issues of what we would normally call ‘islands’?

## Island Biodiversity session summary

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**Phil Lambdon**, Island Biodiversity session chair, Centre for Ecology and Hydrology, Banchory, UK

The issue of biodiversity research on islands is an emotive case study provoking a high level of interest. The session has provided a focused discussion with a number of interesting responses. Clearly, there is a high level of concern over the state of island ecology at present – 12 contributors voiced a high level of urgency, and several described a wide variety of pressing threats to be addressed, both to ecosystems and to individual taxa. Most of the debate was from a European perspective, although a few contributors were able to provide a more global overview.

Our essential question was: How can we make biodiversity research more relevant to policy? A variety of solutions were advanced, although these fell into a few major themes:

- (1) Quantification of existing biodiversity (6 calls)
- (2) Better understanding of genetic diversity within species (2 calls)
- (3) More research into ecological interactions within ecosystems (4 calls)
- (4) Research into the effects of human degradation of the environment (4 calls)
- (5) Research into the problems posed by biological invasions (5 calls)
- (6) Development of sustainable management practices (5 calls)
- (7) Conservation-orientated studies of threatened species (2 calls)
- (8) Development of understanding of social attitudes to biodiversity (2 calls)
- (9) Prediction of the consequences of global change for island ecosystems (2 calls)
- (10) Research into the problems of overexploitation of natural resources (1 call)

Opinions were well balanced between the European and global perspectives.

The most frequent wish was for more basic auditing of current biodiversity levels. Many taxa remain poorly known, and a common call was ‘how do we know what the problem is if we do not yet know what is there’? The problem was felt to be exacerbated by a loss of taxonomic skills and a decline to unfashionable status in the eyes of non-ecologists. However, one suggestion advanced was that such basic information would help to indicate biodiversity loss in the face of global change.

These themes encompass a wide-range of priorities, which, as yet, are far from representing a consensus view. This is a reflection of the complexity of the issues involved and how much remains to be done. Some participants emphasized the need for understanding interactions within the ecosystems, such as the ecology of endemic reptile populations, or the dynamics of pollinator-plant systems within natural communities. One example showed how even moderate levels of fishing in the Fijian islands has had pronounced changes to local reef communities. This type of study is essential for the conservation of species, which are already critically threatened. It will also be valuable to develop models, which can predict the consequences of global change.

Immediate pressing problems demand immediate attention, and therefore environmental threats attracted vocal support for more research. The issues most discussed surrounded biological invasions and tourism. However, these problems are heavily interlinked, and the benefits of greater interdisciplinarity between these traditional divisions was stressed by one contributor.

There was a general feeling amongst some contributors that not enough money is being diverted to tackling environmental questions in relation to their importance to global sustainability. However, pragmatism necessitates a positive outlook, and this highlights the importance of using available resources efficiently. One point made was an impression of a shortage of ground-level research in order to parameterise models and provide data for databases. There seemed to be some consensus in that field-studies were overwhelmingly demanded, and there was also an absence of calls for metadata studies. However, the value of modelling as a complimentary tool was emphasized, for example in its value for understanding the biology of threatened turtle populations.

Social engagement with biodiversity has probably been somewhat neglected in the past, but undoubtedly holds a major key to achieve the implementation of changes, as was highlighted in at least two contributions. One view was that we should market our science better in order to raise the profile of biodiversity issues. Cross-communication between science and policy was suggested as another area where improvements could be made. Integration of theoretical and applied research was viewed as sometimes ineffective. This was illustrated with issues such as reserve design in the Canary Islands, where some designations may not be effectively protecting enough important habitat and species. Another case was the potential impacts of removal of trade barriers on Malta, where the potential environmental impacts may have been deferred to the desire for political change.

Island biodiversity is an asset, which is currently under imminent threat, and the need for more research is not greatly disputed amongst concerned stakeholders. However, there are many areas of study, which need to be addressed. Whilst priorities for research vary considerably from different perspectives, four key areas have emerged as of particular importance:

- (1) Auditing the state of island biodiversity
- (2) Improving knowledge of ecological interactions in threatened habitats
- (3) Focused studies tackling environmental threats, especially invasions, urbanization and tourism
- (4) Dealing with the human element - integrating science into policy.

Whilst there is still much scope for discussion within these broad topics, it provides a step towards a framework, which may be useful in guiding the forthcoming debate.



## Science-Policy Interface

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## Introduction to the Science-Policy interface session

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**Sandra Rientjes**, Science-Policy interface session chair, ECNC, The Netherlands

The Message from Malahide and the Killarney Declaration set ambitious goals for biodiversity research in support of the 2010 targets. Experience shows, however, that successful interaction and cooperation between research and policy is not unproblematic. There are many examples of constructive and effective cooperation between biodiversity research and biodiversity policy making; there are, however, as many cases where the interaction was marked by frustration, misunderstandings, disappointment and a lack of substantial progress or positive results.

Is there truth in stereotypes?

Stereotypes can be illuminating. One common stereotype in science policy interaction is that of the policymaker asking impossible questions of researchers and having eye only for short-term political gain. On the other hand there is the stereotypical researcher, who is interested only in finding funding to pursue his/her own pet research topic, sometimes ad absurdum. Both stereotypes are just that: stereotypes, and therefore not an adequate representation of reality. They do, however, give an indication of certain characteristics of the interaction between science and policy.

Speaking from a social science perspective, science and policy making are two different fields of activity, with their own goals, priorities, quality criteria and rules - and even with their own language. Although in our particular case scientists and policy makers will both support the overall goal of stopping the decline of biodiversity by 2010, their role in the process of achieving the 2010 targets differs, as indeed does their opinion on how the goal should be achieved.

The main difference is the position of scientific knowledge in both fields. Whereas for researchers the production of scientific knowledge is -often- the overall aim of their activities, for policymakers such knowledge is only one of the ingredients needed to develop, implement and evaluate effective policy. Inhabitants from the field of science and the field of policy may also have different views on what constitutes 'good' knowledge. Researchers are aware that knowledge has to be applied in biodiversity policy in order to have an impact, but for them a whole spectrum of criteria related to methodology, theoretical orientation and data quality determines whether knowledge can be considered 'good.' Researchers tend to be acutely aware of the complexity of the matter under investigation, of the fact that conclusions are only valid in specific contexts, and that there always remain unexplored issues that could affect the validity of the research results. Policy makers know that knowledge has to meet stringent scientific criteria in order to be reliable, they are also aware of the complexity of the issue. For them, however, 'good' knowledge will also have to give a clear and unambiguous answer to questions related to the development, implementation and evaluation of policy. Good knowledge for policy makers often will be knowledge that can be delivered quickly, and preferably without high costs.

Missing the point:

Concluding, although researchers and policy makers may share the same goal, they do not necessarily have the same long-term and short-term interests. Combined with the fact that they operate in professional worlds with different rules and different priorities, this can easily lead to misunderstandings, miscommunication, irritation, frustration and sometimes even conflict. In a roundabout way this brings us back to the stereotypes: there is a real chance that to researchers the policy makers' questions will seem trivial, oversimplified and missing the point. The researchers' answers, however, can appear to policy makers to be ambiguous, overly complex and also: missing the point.

Diversity:

An additional factor is that neither the field of research nor the field of policy making is consistent and stable. Within biodiversity research there are many different specialities, and within these specialities there are different, sometimes conflicting - often competing, theoretical orientations and schools of thought. For policy makers this can lead to the problem

that when they ask the same question to two different researchers, there is a real chance that they will receive two different answers. The policy field is equally dynamic and diverse: national, international and regional policies may not be consistent, different policy makers prefer different approaches, political and economic developments can radically change the nature and scope of biodiversity policies. All this has an impact on the input, which the research community can give.

#### Learning from each others experiences

However, it is not all doom and gloom! For every case where the interaction between research and policy was problematic, another case can be found where policy makers and researchers cooperated in a constructive and successful way. One of the most striking examples is the concept of biodiversity itself. Led by E.O. Wilson, a successful coalition of researchers and conservationists managed to draw the attention of the world to the ongoing biodiversity crisis in the late '80s. In 1992 this resulted in the establishment of the CBD, a global policy framework for the protection of biodiversity. The implementation of the CBD in turn has initiated new research in support of national Biodiversity Strategies and Action Plans.

The Amsterdam EPBRS meeting will explore research-policy interaction in the field of biodiversity. The meeting will focus on the process of interaction between biodiversity science and policy making, rather than on the elaboration of an agenda of specific policy relevant research topics. The reasoning behind this choice is that, however sound the research agenda, the chance of considerable progress in its implementation will be limited unless researchers and policy makers alike have a more thorough understanding of the way science-policy interaction works, and unless concrete steps are taken to make this process more successful. This e-conference precedes the EPBRS meeting and aims to identify and discuss interesting cases, stimulate discussion and reflection, and generate tentative conclusions and hypotheses to be debated during the Amsterdam meeting. Participants in the e-conference are asked to share their thoughts and their experiences (positive and negative) on interaction between research and policy in the field of biodiversity

We are especially interested in hearing participants' experiences on the following issues:

- Building coalitions between researchers, policy makers, politicians and other stakeholders such as NGOs and the media in order to influence the societal, political or funding agenda;
- Translating/transforming policy needs to manageable and realistic research;
- Facilitating the adaptation of research results into policy.

The floor, however, is open for contributions related to any aspect of the science-policy interaction.

## Problems of the Science-Policy interface

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**Frank Wätzold**, UFZ, Leipzig-Halle, Germany

Problems of the science-policy interface: Would a Council of Scientific Advisers for European Biodiversity Conservation Policy help?

In responding to Sandra Rientjes' call for experiences related to the science-policy-interface I would like (1) to highlight two aspects which according to my own experience are highly important with respect to the science-policy-interface: The different time frames in scientific research and policy making and the incentive structure for scientists and policy makers to participate in the science-policy interface. Furthermore, I would like to make a suggestion for a Council of Scientific Advisers for European Biodiversity Conservation Policy.

The problem of different time frames:

Those who are interested in scientific information relevant to policy making often need this information on a rather short term basis within a few months or one or two years. Examples are the policy maker who needs information for drafting, implementing or evaluating a certain piece of legislation or the NGO that is struggling against a development project which would negatively affect certain conservation goals. By contrast, the scientific process often delivers results and information on a rather long term basis. Taking EU-funding as an example it may well take more than five years from the first idea of a project over waiting for a call where the proposal can be submitted, writing the proposal, having it evaluated, negotiating matters with the Commission, starting the research (which may out of necessity take two to three years itself) until the final results are published. These different time frames in the political and the scientific arena can make the co-operation very difficult even if both sides are interested in it.

Incentive structures:

This, however, is not necessarily the case. The career of scientists largely depends on their scientific output (in journals) and only to a much less extent on whether they are involved in policy advice. At least in my own discipline, economics, it is often very difficult to publish the work that has been done for policy making in scientific journals. Therefore, in terms of career prospect there is little incentive for scientists to be actively involved in policy advice. On the other side of the table, the incentive structure may be a bit better. However, taking into account scientific knowledge in policy-making may be a burdensome process and imply a lot of work. Furthermore, the results of the scientific research may be critical of current policies and thus may be in conflict with the policy makers' goal of recognition and career prospects. According to my own experiences, these can be reasons for not seeking or refusing co-operation with scientists.

Would a Council of Scientific Advisers for European Biodiversity Conservation Policy help?

I would like to discuss one suggestion that may help to alleviate both problems and increase the effectiveness of the science-policy interface in the field of European Biodiversity Conservation in general: the setting up of a Council of Scientific Advisers for European Biodiversity Conservation Policy. Following (for example) the role of the German Council of Environmental Advisers such a body would comment on policies affecting biodiversity and point to areas where it feels that deficiencies exist and suggest policy (and/or) research initiatives to remedy such deficiencies. Members of this council would be academics with an outstanding research background and a good understanding of policy processes alike from a variety of disciplines from the natural and social sciences. They would be appointed for a certain period and then be replaced by other experts. Such a council would be so prominent (this is at least the case in Germany) that it is an honour for scientists to be a member (increasing the incentives for scientists to do policy relevant research) and difficult for policy makers to neglect its advice (giving an incentive for policy makers to listen to the Council). The task of the Council members would not be to do own research but to take up existing research and feed it into the policy process with the aims of influencing the process and of

providing a timely response to requirements from the policy process. This would make the different time frames of scientists and policy makers more compatible.

I am looking forward to comments related to this suggestion.

#### **RE: Problems of the Science-Policy interface**

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**Kajetan Perzanowski**, Carpathian Wildlife Research Station, Museum and Institute of Zoology PAS, Ustrzyki Dolne, Poland

In my opinion this is an excellent idea, which should be implemented at both EU and national levels. I have an experience in cooperation with provincial government and the directorate of state forests and in both cases it is exactly like that described by Frank Wätzold: they need an answer, opinion or expertise right now, and if I tried to start a relevant research program it had to take several years.

The only problem I see at the stage of appointing such scientific body is - who would make the appointment and what the criteria be for selection? It should definitely not be done by political bodies. It could probably be an open call for experts with clearly given criteria and priorities, and subsequent selection based upon submitted CVs, publications, expertise etc.

#### **RE: Problems of the Science-Policy interface**

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**Ioannis Karakassis**, Marine Ecology Laboratory, Biology Department, University of Crete, Crete, Greece.

The idea of appointing a body of experts on Biodiversity is interesting but as was pointed by F. Boero is not an easy task. The use of the term “biodiversity” in the aquatic bibliography has expanded during the last 10 years at an almost exponential rate. A quantitative analysis of the bibliography addressing the issue of biodiversity showed that it is mainly dominated by reviews or policy-oriented articles rather than articles referring to field data or models. Furthermore the published information at least regarding the marine and freshwater ecosystems is largely biased:

- Some areas have been investigated more than others
- Some taxa (particularly the “charismatic” ones) have attracted more attention than others
- Some approaches (community ecology) have been used more than others
- Some countries had the resources to fund projects on biodiversity whereas others (and probably those where biodiversity is higher) had no structured programmes for the study of biodiversity.

Biodiversity is a field incorporating information from a variety of disciplines (from genetics to ecology, from palaeontology to social science and from systematics to economics) which have developed in separation and use different “languages”. It is possible that biodiversity research will mobilise human and financial resources to provide a new “human genome” case in science or it will become a “non-concept” with various groups using “biodiversity” in a different meaning.

#### **RE: Problems of the Science-Policy interface**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Università di Lecce, Italy

My answer is Yes. It is strange that such council is not there yet. But I have another question: who is going to decide the composition of this council? I ask this question because there are



lots of people who claim to be experts in biodiversity, and they are not. They are, however, very active in saying that what they do is biodiversity. So that, now, biodiversity is almost synonym of biology. But it can also be just computer science, the cataloguing of unchecked and unvalidated data. During a meeting on a BIG European project on biodiversity information I dared ask what was the accuracy of the data that were going to be put into all these nice computers. The question annoyed the proponents very much. The project was to make a database, not to check the data! I dared insist a little bit. A data base is useful if the data are reliable. But all this was becoming too obnoxious, so I simply left the room and disappeared. This occurred to me twice, in two different projects. The greatest majority of the people in the room did not care about the accuracy of data, they wanted just to build a data base. Maybe, the only way to build up such council is to ask the Institute for Scientific Information to make a list of people publishing papers on biodiversity and then rank them according to the different types of biodiversity research (taxonomy, ecology, genetics), and choose the most productive ones. This production-based choice of experts is seldom applied. And this is a mystery to me. It is evident that there are other ways to be “influential” than publishing papers in good journals.

### **RE: Problems of the Science-Policy interface**

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**Rainer Muessner**, CIMAR, Porto, Portugal

After the very well written topic started by Frank we have already several replies to the issues raised by him. The part he wrote about a Council of Scientific Advisers for European Biodiversity Conservation Policy seems to be of particular interest to the audience of this session. Kajetan and Fernando gave comments about the selection criteria for participants of this (or other) councils, but to me this question is really of secondary concern. Besides the fact that I think, that scientific selection criteria like “publications” are not useful for these panels I guess we are dealing with “internal” problems of the Biodiversity science community (selecting representatives of the Biodiversity science community).

Wouldn't it be more useful to ask: What can the main function and benefit of this council for society be besides the status quo of science-policy interaction? How to establish optimal linkages to the wider policy decision-making process? Who has to give the mandate? How to convince the policy side to support it? How to keep the independency of advice in ever closer relations between science and policy (e.g. research funding, public positions) (see negative example from experiences of advisory councils in the United states (Randerson 2004) What could the justification for a council of Biodiversity be compared to other research fields that don't have one? (Some may say we already have enough councils, expert panels, and advisory committees) When to choose a permanent Council and when to choose some kind of task force with the same objectives? How to institutionalise it? And last but not least: How to evaluate the effectiveness of such a council?

When we really like to convince policy to build a forum like this we should start with these questions and not start with the delegates to the council. And by the way: Isn't EPBRS something like that council, maybe just a little bit more focused on Biodiversity Research Policy instead of Biodiversity Policy in general?

Nobody replied till now to the second part of Frank's mail about the incentive structures. This seems very important to me, because it tackles the central point of motivation for science-policy interaction.

Why should politicians listen to scientific advice and why should scientists try to give policy advice. Beside the pure “honour” to be in any kind of policy advice committee or council there is not much to be earned here. The well chosen example of Frank about the German Council of Environmental Advisers (Sachverstaendigen Rat fuer Umwelfragen), that indeed works were fine and their reports are highly appreciated in the scientific AND the policy community, shows that it is not only “honour” or “reputation” alone that makes well known and respected scientists collaborate here. At least there are two other incentives:

1. Each member of this Council is getting half a researcher's position (BATIIa1/2) to prepare draft reports, background studies about relevant issues and for editing and administrative purposes.

2. The council itself is very well supported by the relevant ministries and has a functioning secretariat. If you see that someone (policy) is investing resources to hear your opinion it is likely that they will listen (or in this case read the reports) and you are motivated to give advice. Obviously even for the politicians it seems not to be what Frank described as "time consuming and burdensome process". Investing resources (time, money) means someone values what is done.

This positive feedback the members get from the meetings and work done is in sharp contrast to the feedback these people get from their employers and from other colleagues. Most employers don't like when you are often out of the house for this kind of activities. The positive effects on your career are relatively small compared to classical criteria like "cited publications" and the work you do is not considered to be "first class science" by the colleagues in the field of Biodiversity.

How to change the incentive system for people doing policy advice therefore seems to be one of most urgent cases in the area of science-policy interaction.

## **Biodiversity committee**

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**Alan Feest**, Water and Environmental Management Research Centre, University of Bristol, UK

The conference has been of great value so far and the idea that seems to have taken root is the Committee on Biodiversity (or some such name). There are a administrative problems pointed out by other contributors but perhaps the two most important problems have yet to be solved and these are fundamental to any further progress: what is biodiversity and how is it measured? Until we have a definition that is more useful than the one provided by the Convention on Biological Diversity (which tends to equate biodiversity with number of species) then we are not going to make significant progress and we will not know where to progress!

A common feature of the attempt to answer the above questions is to use indicators but the use of indicators is really to avoid the actual question of whether the unknown thing called biodiversity has been preserved, enhanced or lost.

As an example of the problem of using indicators the following is a useful case: In the UK it might have been useful to measure bird biodiversity by looking at the success of top predators such as Buzzards, Sparrow Hawks, Hobbies and Red Kites (and this has worked in the past in regard to the problems of pesticides). They fulfil most of the criteria used in the selection of indicators such as: charisma and public importance, ease of observation and counting, and ecosystem position (top predators). In the last ten years all of these species have shown a dramatic increase and the observation could be made that this indicates that the birds of the UK are doing well. We know from numerous other observations that this is very far from the real case. The fault therefore is that indicators are just what the word says and that the reliability of the indication is almost never understood or measured.

So my question is: when and how are we going to arrive at a better definition of biodiversity so that we can then direct our efforts towards its conservation and use? Could this be the first activity of the "Committee"?

Sorry to set the discussion back to the beginning but it seems essential to be able to progress in the right way and with a compass!

## **RE: Biodiversity committee**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

There are three definitions of biodiversity: species, habitat, genes. I cannot see others. Species is anyway the strictest definition. I cannot understand why species are not good as a start. Well, I know, because it is difficult and because there are no more taxonomists. But this is not a good reason. I think that the three definitions together are the good answer. indicators are surrogates, but then how can we know if they really indicate the right thing? So the question is not what we want to measure, but how to measure it. In other words: we cannot recognise all species, so can we find a surrogate? Is this what we really want? This is the reason why taxonomy disappears, because people think that there can be surrogates. The question might be turned into another way. Would biodiversity be the same without all these species? If the answer is no, and I think it is, how can we dream of measuring it without knowing the species? of course species are not enough, but they are the starting point. Waiting for that, we can try to measure habitat diversity. But the same habitat type can contain different numbers of species, so how can we say that two habitats are really the same, if they look the same but contain different numbers of species? Sorry guys, we cannot avoid considering species while talking about biodiversity. We can ADD things, but we cannot avoid this question. The sooner we accept this simple thing, the sooner we will invest energy in answering the basic

question posed by Robert May: how many species are there on the planet? This is the core of biodiversity.

**RE: Biodiversity committee**

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**Alan Feest**, Water and Environmental Management Research Centre, University of Bristol, UK

My question was not to do with using species to measure biodiversity but with the assumption that the measured NUMBER of species for a site indicated its biodiversity. This latter point assumes that all species are equal- they are not; some are larger than others, some rarer, some have a higher political impact, some are more abundant (numbers per unit area), some have a more important ecological role. Simply registering the list of species present on a site does not indicate very much and yet this is frequently the nature of the information we have available. Basing biodiversity on species (whatever we might decide they are!) is a practical result of a difficult situation since conservation of genes requires too much genetic analysis and habitat conservation conceals species biodiversity properties of those habitats (despite the need to conserve habitats as the basis of species conservation). I therefore agree that the basis of biodiversity is the species of the site but simply to record the number of species will not suffice for registering the biodiversity properties of the site.

The point of the species biodiversity value is brought by the following case: Large areas of UK woodland are dominated by relatively recent plantations of coniferous woodland and the general approach for biodiversity conservation is to replace these woodlands with native broadleaf trees. I now have a lot of data that shows that this replacement of conifers with broadleaves brings about a dramatic decline in macrofungi in terms of numbers of species, biomass, rare species, numbers of fruit bodies etc. So how do we resolve this case to decide on future policy as to whether to replace coniferous woodland with deciduous trees? I think I know the answer but it is still an interesting question to ask. A similar question is exemplified by comparing different sites: site A has 100 species but all of them are common and site B has 40 species but most of them are rare. Which has the highest biodiversity? Which should receive the greatest protection?

A separate question is what group of species should be studied or should be considered the most important? Here we are up against the problem of lack of taxonomists and the need once again to balance the importance different groups e.g. mammals vs birds vs fungi etc. I have no answer to this other than to say that an experienced ecologist (not a specialist) would understand the potential of various sites for the different taxonomic groups.

I therefore suggest that there is a need for a change of concepts from the consideration of biodiversity as a single entity to one where biodiversity is a quality with a number of properties that can be measured; this latter point then requires standardised sampling techniques (but that is another story!).

I probably have now succeeded in confusing the issue even more but policy must be based on facts and we need to agree what are the facts.

**RE: Biodiversity committee**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Università di Lecce, Italy

Thanks for the explanation - now I understand. With two colleagues I have written a paper on species roles in the journal *Marine Biology* (reviewed also by *Trends in Ecology and Evolution*), and these things are more or less addressed. There are other measures of biodiversity, like taxonomic distinctness proposed by Warwick and Clarke, but they are more relevant in the sea, where there are many phyla. 100 species of the same phylum, are not the

same as 100 species of 10 different phyla. And so on, you can use it also for lower ranked taxa, though. What I get from your message, thus, is that we must compile the species list, but then we have to use it to understand what is the better procedure to obtain our goals (i.e. information about the status of biodiversity). No problem, this is very good. Well, you know, each name tells us a story if we know about the species. Of course there are species that play greater roles than others, but it is not so obvious. bacteria have a much greater role than whales in ecosystem functioning. And the widespread use of antibiotics might impair ecosystem functioning in a way that is not so easy to grasp at first sight. The problem is that we do not know much about species roles, so we stick to the most obvious ones. I am a fanatic of resting stages of plankton, and I have argued several times that the resting stage banks in the sediments are very informative of the biodiversity of a given place, in terms of potential biodiversity. The idea stems from soil seed banks, so it applies also to land (I copied it from land ecologists). I stressed that species list are not enough, but they are necessary. Necessary but not sufficient. Take the European Register of Marine Species. It is a great enterprise. But what is hidden behind each name? Can I say that I know the people of a town by inspecting the phone book? The genome project is the same thing. Now we know the genes, but we do not know what they are coding for. I am caressing the idea of some sort of historical biodiversity index. The idea stems from a paper I wrote in 1993 on the hydrozoa of the Mediterranean. At that time I listed (with my friend Bouillon) almost 400 species (by the way, if you go to the web page of the journal *Scientia marina*, in the special volumes section, you will find a downloadable monograph on the hydrozoa of the Mediterranean), almost doubling the species list compiled by Picard in 1958. So the biodiversity of the Mediterranean increased, according to our data. Is that true? Every time we make a regional list, we add the newly recorded species to the old records. Then, if we actually sample, we do not find them all. So there is a big difference between what we find and what has been found in history. If we do not find conspicuous species we realise it, but what about the rest of biodiversity? My proposal is to compile species lists for each habitat type, using all the information available in the literature. This gives us the history of biodiversity in that habitat type and yields a number  $N$ . Then we actually sample and we find another number:  $n$ . The historical biodiversity index is  $n/N$ . Very simple, almost childish. With this number (ranging between 1 and 0) we know what we have found and what we have not found. Of course the number is irrelevant unless we do not go into the list and look at what is missing (and at the new entries, of course). Such an exercise, for animals, can be done just by groups (e.g. my hydrozoans) but botanists can do it for the whole plant contingent. The prerequisite is to compile master lists for each habitat type (we are compiling them for hydrozoans right now) and, of course, we have also to compile a list of habitat types (not an easy thing in the sea, or too easy because there are too many and they differ from each other).

Your example of conifers vs. deciduous trees is obvious, and you say you know the answer. I think my answer is similar to yours. There are many things that are not clear, though. Think about hotspots of biodiversity. We say that they are places where biodiversity is very high, right? And they are important because they are a source of biodiversity for other places that are poorer. This falls within the source and sink theory. So, hotspots are a reservoir of species that are then distributed around. But then, when these species arrive at other places, where they were unrecorded before, we say that they are aliens. And aliens are seen as a bad thing. So we end up with a schizophrenic attitude. Of course there are different types of aliens, but it is almost to be expected that, for instance, if there is a climate change towards global warming, then warm climate species will spread towards the usually colder climate sites. We can go further than this, and say that climate change is our fault, so this biodiversity shift is unnatural and so on. But this is just an example to show how difficult it is to deal with these things.

Summarising: we need to know the good old natural history for all our species. Giving a name to a corpse in a vial is not enough. And once we know the natural history of each species, then we have to learn how they interact with each other. It is a very long way to run. Ecologists tried to perform ecology without knowing the species (besides the more obvious ones) and forgot about biodiversity. There is a cultural gap between ecology and

biodiversity. And there is a cultural gap between taxonomy and ecology. So there are two worlds that are the same thing and do not speak to each other.

When I say these things, taxonomists do not like me, and neither do ecologists. Maybe we need a psychologist. Ah! I forgot evolutionists. Think about it. Darwin's book was a book on ecology, then evolution became pervaded by a reductionistic approach, ending up with hard core genetics (or paleontology, but these two types of evolutionists do not speak to each other). The other champion of evolution was Haeckel, with developmental biology applied to evolution (ontogeny and phylogeny). The modern synthesis used lots of disciplines, but it ignored evolution and development. Life sciences are pervaded by reductionism and by cultural barriers. The reason is simple: there are too many things to know, so we stick to what we know and we ignore the rest, refusing to know more. The result is that we often use the same words with different meanings and then we do not agree on what we are discussing. As is the case for biodiversity, as you correctly pointed out.

Sorry for my long answers. But complicated things, in our field, cannot be reduced to a simple formula or sentence. This is the reason why we are not so influent. We need to speak too much to explain our views. Politicians like slogans.

**RE: Biodiversity committee**

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**Sandy Knapp**, The Natural History Museum, London, UK

Dear all involved in the discussion of how to monitor and measure biodiversity- I suggest reference to the UK Royal Society's Report on Measuring Biodiversity for Conservation, available at [www.royalsoc.ac.uk/document.asp?id=1474](http://www.royalsoc.ac.uk/document.asp?id=1474), where a useful framework for assessing these issues is presented.

## **Biodiversity indicators and the science-policy link**

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**Ben Delbaere**, ECNC, The Netherlands

Alan Feest calls on us to agree a definition for biodiversity, which should be more useful than the one provided by the CBD as this tends to equate biodiversity to number of species. Although there is much to be said for using another term than 'biodiversity' for communication purposes, I feel we should not open up a discussion about what is understood by the term. The CBD clearly does not reduce biodiversity to number of species, but explicitly addresses ecosystems, species and genes. Also in terms of how to measure biodiversity the CBD process has led to a set of indicators that go way beyond species numbers.

This set of indicators (8 for immediate testing and 13 for further development) was agreed at the 7th Conference of the Parties after a process of many years with an intensive iteration process between scientists (represented through SBSTTA or specific expert groups) and policymakers (COP). This process of agreeing a set of indicators illustrates what it takes to make the science-policy link work. One may have comments and criticism on the agreed set of indicators and it may be questioned whether the time investment to reach such set is justified, but the importance of having this set agreed is not to be underestimated.

With the agreement at EU, pan-European and global levels to stop or significantly reduce the current rate of loss of biodiversity by 2010 and the adoption at these same levels of lists of indicators for measuring progress of the achievement of the 2010 target a strong stimulus is given to actually implement and test indicators for this purpose. Consultation processes are ongoing at various levels and with involvement of scientists, policymakers and other stakeholders, of how these indicators can be underpinned with data, how they can best be communicated and how the messages they convey can be linked to policy measures and their effectiveness. A case in point is the initiative on implementing European 2010 biodiversity indicators (IEBI2010) as coordinated by EEA with its ETC/NPB, ECNC and UNEP-WCMC.

This is not to say that all problems are solved now and that the indicators will answer all our questions. Apart from the international implementation processes there is clearly a need, as indicated in this discussion, to share experiences on how the science-policy link can work better. The National Biodiversity Fora are clearly good vehicles to bring science and policy together at national level. At European level, though, I share Katalin Török's opinion that there is no need nor time to establish a new body (council or committee) to act as broker between science and policy. I'd think that the EPBRS does or should have this function, together with other initiatives, such as the Networks of Excellence and their links to policy. It would probably be more efficient to ensure that the EPBRS facilitates the interaction and consultation between European scientists and policymakers, if it doesn't do so now. The question therefore should focus on how this can be supported. For example, I would imagine that in Europe regular meetings of the EPBRS and other biodiversity groups with policymakers in European Council and European Parliament would be useful to discuss and present biodiversity issues.

## **RE: Biodiversity indicators and the science-policy link**

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**Alan Feest**, Water and Environmental Management Research Centre, University of Bristol, UK

I have replied to Ferdinando by asking a series of questions and would like to know how indicators solve those questions. If the indicators are quantifiable and subject to standardised sampling then perhaps they might if they are presence absence data then they probably will

not. Have these indicators been evaluated for reliability? Just to say that some big conferences have agreed something does not prove they have got it right.

### **RE: Biodiversity indicators and the science-policy link**

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**Ben Delbaere**, ECNC, The Netherlands

Your question will be answered by the mentioned initiatives towards implementation of the politically agreed indicators. For example, for Europe I referred to the IEBI2010 work. For each of the EU biodiversity headline indicators expert groups will assess issues such as data availability, reliability, suitability, links to pressures, value for communication purposes etc. For the specific indicator on species abundance and distribution (not species numbers) the issue of which taxa to use will be addressed as well. So in this case the politics (lists of indicators agreed by heads of state and government leaders) is brought back to experts to show how these can be used for measuring progress in achieving the 2010 target. This in turn will result in information for policymakers to act upon.

### **RE: Biodiversity indicators and the science-policy link**

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**Rainer Muessner**, CIMAR, Porto, Portugal

Sandra Rientjes argued in her introduction that there are many cases where the interaction between scientists and policy was marked by frustration, misunderstandings, disappointment and a lack of substantial progress or positive results. Also she outlined positive examples at the end of her introduction; I guess she is more than right describing the situation in this way. From my experiences the majority of science-policy communication can be described as above.

Why is this the case? From my point of view there are two main reasons for this: wrong expectations and missing communication competences, in particular on the science side.

Wrong expectations:

In cases where science-policy communication was disappointing the underlying reasons have very often been wrong expectations from the other group/side. Scientists give advice and expect politicians to follow that advice, neglecting that scientific advice/knowledge is just one ingredient in the process of political discussion-making and that their decisions affect multiple sectors (Reid & Mace 2003). They don't accept that policy-makers have different goals and priorities and they have to take into account much more than "Biodiversity problems". In their self understanding in the process of giving policy advice, they think they have to prove (scientifically) that their information given is correct or "good" (Oreskes 2004). Unfortunately in a complex field like Biodiversity very seldom do we find this but rather indications for relations or more or less stable evidences. Therefore politicians should not expect proofs and scientists should not try to give them. What scientists are asked for, is to give advice based on their expertise, to present their "justified believe" (Thiele 2004), nothing more, nothing less.

Another particular problem of scientists giving policy advice is what everybody in society seems to know about scientists and this has developed in the common saying: "Ask two professors and you get a minimum of four different answers".

Scientists are used to dispute, because the scientific dispute is something that is essential to bring forward science itself, but is rather frustrating for politicians who look for clear advice. They like to make their decisions on the basis of a broad consensus, because they know from their political work the value of majorities. On the other side, scientists very often do not make the point and give a clear statement, but rather prefer to raise doubts and



questions about decisions that are to be made. They like to give advice, but prefer not to take the responsibility for the decision-making, sometimes they are not even interested any more in the “follow-up”, the policy-making in the narrow sense. The most difficult target in any case of expert panel or advisory body is therefore to find a consensus and not to find or prove a temporary scientific truth. In many cases the process of finding consensus leads to a simplification or a minimalistic consensus, where scientists don't feel comfortable. Unfortunately we have to confess, that most scientists are not specialists in consensus/ compromise finding, which leads to one of the biggest deficiencies of conservation scientists in my opinion.

Missing communication skills:

As outlined in the last section of Sandra Rientje's introduction, the Amsterdam meeting is more focused on the process of science-policy itself, than on finding important research topics in this area. I think that most conservationists today have some kind of classical education of natural sciences in universities, where they have been taught taxonomy, ecology, botany and other things, but that alone doesn't qualify them as good policy advisors or qualifies for a “council of scientific advisors”. What is missing is a general understanding of scientists about decision-making processes in policy and the elaboration of policy outputs like regulations on sub statutory level and of laws. Even in natural sciences curricular at universities today, where the leading scientists of tomorrow are educated by now, you hardly find a course or seminar about communication, conflict resolution or environmental policy-making.

The book edited by Sandra Rientjes in the ECNC series about “Communicating Nature Conservation” (Rientjes 2000) should be a bestseller for every conservation student and in the conservation science community (please note: I'm not her publisher!). It should be some kind of essential handbook of reserve managers, NGOs and scientists that like to give policy advice. Unfortunately this is not the case and I have my doubts if books like this one are really high on the “reading-agenda” of most scientists working in the area.

As outlined above, the image of the scientist in society is not the best and in particular in the field of Biodiversity there is the persistent prejudice against scientists that they care more about spiders and beetles than about people. Most of us know better, because conservation itself is as much about people as it is about animals and habitats (Jepson & Canney 2003). Even so, we have to work hard to overcome this prejudice to make people listen more to our arguments. Therefore the education of natural scientists (curricula) should change to overcome our fundamental communication deficiencies with groups outside the scientific community (wider society including politicians). In Biodiversity we should start to read more books like “Communicating Nature Conservation”, because it might be that it makes us more successful and less frustrated in giving policy advice.

## Interdisciplinarity in conservation

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**Swen Renner**, Conservation and Research Centre, Smithsonian Institution, USA and Zentrum fuer Naturschutz, Universitaet Goettingen, Goettingen

Rainer Muessner and Sandra Rientjes are right stating that conservationists have got to 'read the right books' and have to work hard to overcome prejudice. Nevertheless, communication between scientists and policy is important but also communication between scientists of different disciplines is as important as well and maybe has got to be improved first or at least at the same time.

Complaints of scientists about scientists are frequent: du Toit et al., Terborgh, Kaimowitz Angelsen, and others argue that effective interaction between ecologists, economists, sociologists and political scientists is necessary to conserve tropical biodiversity. The question remains, why are there so few projects in which such collaboration takes place (du Toit 2004 and Terborgh 1999). One answer lies in understanding scale; another is the understanding of science and discipline background. The following example illustrates one of many reasons why interdisciplinary, and therefore contemporary conservation projects, might be failing.

The German Science Foundation (DFG) implemented a graduate student working group (16 disciplines represented by 16 PhD students and additional 16 professors from disciplines like ecology, landscape ecology, economy, law, anthropologists, and political sciences) to investigate (i) the background of conservation of biodiversity in Guatemala and Germany and (ii) to train young German scientist to collaborate and communicate closely. During a discussion to implement a project involving both ecological and the economic perspectives in Neotropical community forests, sever problems occurred. Firstly, ecologists and economists use different languages (e.g. definition of the term biodiversity (Renner 2003, Manez-Costa & Renner 2004, Gaston 2000, Hawkins et al. 2003)) – the definition of non-scientists might aggravate this situation. Secondly, while ecologists might gather data on scales up to few km (except when analysing broad-scale patterns which are mostly of more theoretically nature (Gaston, 2000 & Hawkins et al. 2003)), economists prefer larger samples in regions, i.e. several 100 km or entire countries (e.g. Manez-Costa, 2003). Additionally, both parties use different areas of investigation, which are currently almost never closely located. When an economist uses already published ecological information, he or she is satisfied with general assumptions from different parts of the country (Angelsen & Kaimowitz 1999). This might be spurious if data from the Amazonian basin, for example, is used for economic studies in Andean high elevation areas. On the other hand, ecologists gather samples that are rarely representative of larger areas and therefore unwise to use for extrapolation.

Whilst the discussion was not successful in the first trial, it was finally agreed that e.g. ecologists and economists should communicate in the beginning to ensure that future interactions will be productive.

## Multidisciplinary approach- the wet heaths example

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**Jan Jansen**, Radboud University Nijmegen, the Netherlands and ICN-Portugal

In general we know a lot about ecosystems and how to technically manage them. However we keep on losing more surface and quality. Obviously there are other problems than only the technical ones. Take for instance the wet heaths.

Five years ago I made an information package for the Management Master Plan for the Natural Park Serra da Estrela, with 1000 km<sup>2</sup> the largest Natural Park of Portugal. For each Natura 2000 biotope I listed its vulnerability and gave advice on management. Here I pick out one of them: 4020\* Southern Northern Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*. Phytosociological classification: Class 34. CALLUNO-ULICETEA; 34a. *Ulicetalia minoris*; 34a.2. Genistion micrantho-anglicae; 34a.2.1. Genisto anglicae-Ericetum tetralicis Rivas-Martínez 1979; 34a.2.2. Potentillo herminii-Callunetum Rivas-Martínez 1979; subass. pycnothelietosum papillariae (Jansen in Boom & Jansen 2002); subass. genistetosum anglicae (Jansen inéd.)

Vulnerability: eutrophication (manure, fertilizers); water extraction; heavy trampling by cattle, sheep and goats; active conversion to woodland; abandonment (natural succession).

Management: prevention of aforementioned threats by legislation and surveillance; prescribed burning; support of traditional land use (transhumance).

Although research is still really needed (especially macrofauna and fungi), we often do know more or less what ecosystems we have, what their vulnerability is and how we should technically manage them. It seems there is another problem than a pure technical one.

Despite of our technical knowledge many of the ecosystems like the wet heaths still deteriorate or even disappear. The problem of monitoring is left here without consideration, since it has been addressed elsewhere in this platform.

The wet heaths were for a long time part of the heathland-based farming system in the Serra da Estrela. Now this system is collapsing and the biotopes are at risk, vulnerable as they are for land-use change. Traditional farmers have been safeguarding the EU-directives (Bird, Habitat, Nitrate, Water). Now they disappear, now we really need them!

Who will now execute the management procedures - The management team of the Park (ICN), the local population? The management authorities have no money. The management team of the Park experiences a strong pressure from the municipalities that have economic interests (ski-tourism in particular). In case of Serra da Estrela, which is a Natura 2000 site, there is legal aid: the Habitat Directive. On the other hand: management that is only forced by law is not very convincing and probably not sustainable in the long term.

Attempts to keep/restore the wet heathland system or any cultural landscape element in particular, without considering the wider context (ecologic, economic, social) will provide only partial solutions, and are almost certain to fail in their objectives.

The capacity of the wet heaths to survive has its limits. The aim of resilience analysis and management is to understand these limits, how to keep the system away from them, and how to influence the factors that directly/indirectly define the limits of the ecosystem or CLE's existence. See:

[www.resalliance.org](http://www.resalliance.org) and [www.millenniumassessment.org/en/products.chapters.aspx](http://www.millenniumassessment.org/en/products.chapters.aspx)

An integrated approach is needed, including a discussion platform that aims at gearing all possible functions of the area to one another. In this platform all stakeholders of the natural, economic and social Estrelean capital should participate, trying to find a suitable solution. Rural development and nature management might go together, but that can only be realised by cooperation.

We scientists, like these stakeholders, have to participate with each other across our disciplines. The field of our study is now a cross-scale travel through a number of systems that are interrelated with each other: the ecological, social and economic systems. Innovation most probably comes through the multidisciplinary dialogue. We urgently need good models to attack the problems of globalisation.

## Efficient use of knowledge and new structures

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**Carsten Nesshoever**, Department of Conservation Research, UFZ, Leipzig-Halle, Germany

Based on the contribution by Frank Wätzold, I'd like to state some more fundamental thoughts on the problems on time frames, use of knowledge, incentives and the idea of "new structures". I am well aware that I may leave out some important points or may sound very general in some points, but my path of arguing in short is the following:

1.) Policy advice by science has to be based on current knowledge (not on future research).

2.) As a consequence, existing knowledge has to be analysed and applied more effectively.

3.) We need new ways of gathering knowledge and doing "meta-analysis" (with specific policy focus).

4.) We may need new structures for that (or use the existing ones?).

ad 1.) The problem of the different timeframes in science and policy was already discussed in previous contributions. Of course the consequence is that policy advice on current topics has to be based on existing knowledge - and of course this is, what policy advisory bodies do - collect and analyse existing data and knowledge in the perspective of a given political problem or policy field. Of course, future research will be one consequence of such processes, too (since it may shape future research programs). I guess, the work of EPBRS in the last years has shown that both points may work well.

ad 2.) Although bodies like the one proposed by Frank Wätzold exist on national and even European level, we have to ask, if the outcome of such bodies, compared to the vast amount of existing research is enough for a proper communication towards policy- and on which level. We have to ask, whether the outcome of "high-ranking" advisory bodies really influences policy making- maybe they just might do it on the general level of political agendas and not on the level of "real" policy making. So we may need more specific advice for more specific topics.

ad 3.) To date, I only know projects collecting and storing DATA in different fields (e.g. GBIF, GTI and many others) and thus laying the foundation of future analysis in this fields. But for KNOWLEDGE in the field of biodiversity, I know of only one, more or less policy relevant compendium, the "Global biodiversity assessment", published in 1995. While the Climate Change debate has IPCC and other bodies to come up regularly with highly acknowledged meta-analyses, biodiversity science has not yet such a structure or body (of course, there are many reasons for this which I will not discuss here). So, there is no regular and institutionalized high-level review of biodiversity knowledge - and no continuous input into policy.

This brings me to the general question, if the vast field of biodiversity-related topics and the resulting complexity of the topic may need new ways of exploring the knowledge on it. There may be different ways to do so - e.g. by using techniques of knowledge management, data mining etc. which are widely used in business, but to my knowledge, rarely at the interface of science and policy (and in science itself). For this, of course, we need a new way of thinking about what we want (policy) and what we know (science). Additionally, there may be a need that - since scientists and policy makers are stuck in their pathways (of career and work) - we need new structures to do such kind of knowledge collecting and meta-analysis - of course in direct contact with policy makers and scientists.

ad.4) Such new bodies may act as clearing-houses at the interface of science and policy and canalize the needs of policy- and the answers (and needs!) of science to each other, by being well aware of the communication problems both sides may have.

I guess that at different levels, such new structures already exist- rather because "old" ones are changing or new ones are emerging. EPBRS in connection with the e-conferences we are involved in here are such concepts, since it directly addresses the knowledge of European scientists on specific topics without creating new studies. Additionally, the National Biodiversity Platforms (NBPs) promoted within EPBRS and Bioplattform are a rather

important step towards such structures. Of course, also scientific advisory boards might play an important role in such processes.

But again, the crucial point for the successful establishment of such structures is the cross-cutting property of biodiversity as a topic. It addresses a high number of originally separated policy fields (and the stakeholders involved in them).

### **RE: Efficient use of knowledge and new structures**

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**Katalin Török**, Hungarian Academy of Sciences, Institute of Ecology and Botany, Vácrátót, Hungary

I would not support the idea of creating new scientific adviser bodies as there are already so many of such (e.g. in Hungary: expert working groups for the implementation of the Natura 2000 network, biodiversity monitoring specialist support groups, etc.), however, I do not question the existing ones, and the idea itself. But I doubt that this is feasible in a realistic time frame (2010!). I would rather argue to improve and extend the work of the National Biodiversity Platforms, as these have been created to link science and policy. At European level, EPBRS has already demonstrated that communication between science and policy can lead to some results. If we are not sufficiently effective, we should search possibilities to improve, but the creation of new “instruments” would take too much time and energy. If there are such organizations, like in Germany, EPBRS should look for contacts, improve collaboration and mutually strengthen the impact on policy decisions.

Concerning the application of present knowledge, according to my experiences, the lack (or limited access) of meta-databases and review papers is a major obstacle and results the described uncertainties in responding policy questions. Despite the acknowledged scientific difficulties our usual reasoning is “if we do not give the answer, someone, who has even less knowledge will do it”.

## **Science-Policy interfaces for biodiversity governance: the need for dynamic and participatory processes**

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**Sybille Van den Hove**, Institute for Environmental Science and Technology (ICTA), Autonomous University of Barcelona, Spain

Science-policy interfaces are social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, co-evolution, and joint construction of knowledge. I would like to stress two normative requirements for science-policy interfaces when they concern environmental issues: dynamism and participation. These requirements stem from the complexity of the issues and from the nature of scientific activity.

Environmental issues – and in particular biodiversity loss – typically involve complex, non-equilibrium and self-organising systems (including social systems) characterised by properties of emergence, irreducible uncertainties and non-linear internal causality. This complexity implies that science is unavoidably confronted with uncertainty, indeterminacy, ambiguity and ignorance (Wynne 1992, Kay et al. 1999, Stirling 1999). As a result, both scientific and policy knowledge are in constant evolution - actually in co-evolution – and they need to be continually and dynamically exchanged between scientists and policy-makers. Hence interfaces between scientists and policy-makers should be dynamic.

Scientific activity is not a neutral endeavour. Beyond the myth of a science confined in clearly defined boundaries which would be univocally and neutrally defined by methods, it becomes obvious that science is a value-loaded social process whose frontiers are fuzzy. So the definition of what is “scientific” is not as unproblematic as might appear at first sight, as illustrated by the example of the database given by Ferdinando Boero. At the methodological level, the vision according to which there is, and should be, an impervious separation between methodology development and policy advice reflects a simplistic assumption of independence of science. De facto – and quite obviously in the case of issue-driven environmental sciences – the identification of the issue, the choice of relevant scales, disciplines and methodologies, and the strategies to articulate them, are part of a process that is in no way independent from societal values and the socio-political context. And at the individual level, scientists themselves might be at loss if they intend to isolate their scientific work from their values and their place in society as citizens.

Environmental science and environmental policy are not isolated social processes and are better understood as intersecting domains of human activities which are in co-evolution. Although both types of processes have their specific methodologies and operational ways, these are not independent. Scientific methods and normative choices are influenced by the socio-political agendas of the scientists themselves, of the funding agencies and of society at large. Similarly, and probably more immediately recognised, political agendas are influenced by scientific methods, norms and results. Hence, science-policy interfaces should not be understood as processes with clearly defined limits which would isolate it from both science and policy. Because they constitute an important component of policy processes dealing with complex issues, because they pertain to both the scientific and the policy process, and because the scientific knowledge about the issue is not stabilised (Funtowicz & Ravetz 1993), these interfaces should be participatory. Participatory processes are increasingly advocated for decision-making settings to deal with complex issues and uncertainties because they allow the contribution from a wider range of actors, in addition to scientists and policy-makers, and are potentially adding legitimacy and quality to decision processes (e.g., Dryzeck 1990, van den Hove 2000, Stirling 2003). In parallel, for issue-driven research – e.g., environmental science – insistence is put on the need to open-up the scientific process and aim towards participatory science, such as that which is proposed in the concept of post-normal science with an extended peer community for scientific quality assurance (Funtowicz & Ravetz 1993). The strength of participatory approaches is that they potentially allow for the various and often irreconcilable values underlying problem definition and social choices to be explicitly

introduced and accounted for in the scientific quality process (O'Connor 1999; Funtowicz 2001) and in the wider societal debate (van den Hove 2004).

Given the requirements of dynamism and participation just stressed, it should come as no surprise that real-life implementation of science-policy interfaces confront the typical challenges of participatory processes: issues of representation, legitimacy, formality, scale, manipulation, trust, competence, compromises, and so on. This is illustrated for instance by the discussion following Frank Wätzold's proposal to create a 'Council of Scientific Advisers for European Biodiversity Conservation Policy'. The first questions raised by e-conference participants relate to the composition of the council (legitimacy) and the selection of participants. Notwithstanding the pervasiveness of such issues and the existence of a series of additional challenges relating to communication, dynamics, quality of outputs, impact, survival, and relevance of aims and objectives, it is my belief that it is possible to design and implement "successful" (to use Sandra Rientjes' expression) participatory and dynamic science-policy interfaces for biodiversity governance. An example very close to us is EPBRS which is clearly an interface between science and policy (Sharman & van den Hove, forthcoming). Although since it is a platform where scientists and policy-makers work together to define biodiversity research strategy, it is only one element of the wider interface between biodiversity science and biodiversity policy.

## **RE: Science-Policy interfaces for biodiversity governance: the need for dynamic and participatory processes**

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**Felix Rauschmayer**, UFZ, Leipzig-Halle, Germany

If people say that we don't know much about biodiversity to be protected, we have to add that we don't know much about the societal structures meant to decide and implement these decisions. We don't have a systematic analysis of what is actually happening, and therefore we can't elaborate propositions for improving the practice. Interdisciplinary research (based in social sciences, integrating natural sciences) on multi-level biodiversity governance has to be done if one wants to make science-driven proposals (complementing best-practice proposals like the German Sachverständigenrat für Umweltfragen, mentioned by Frank Wätzold).

I won't talk about National BioPlatforms, as we still don't have one running in Germany (and I'd be keen on answers to your questions, Rainer), but I take up your last (but not least) point of the different levels of science-policy interaction.

First: we have (grossly speaking) three different actor groups: policy makers, scientists, and the public (including stakeholders, interest groups, ...). There are two-way interactions possible between all groups, but, in reality, the type and extent of interactions vary. This even more, when regarding Second: the different levels of policy-making. Here, the number of interfaces multiply, as all three groups make decisions on different levels: local, regional, state/national, European, world-wide.

Management of natural resources is characterised by the interdependence of locally restricted regulations of use with externalities of these uses on other spatial scales and on other policy fields. This multi-level and multi-field interplay is reality when implementing national frames and EU directives. E.g. biodiversity issues are characterised by the local specificity of the problem and the difficulty this specificity poses for an overall co-ordination of biodiversity conservation e.g. to reach the EU 2010 target of halting biodiversity loss via the Natura 2000 network. Difficulties encountered by multi-level governance of natural resources are:

- Complex natural and social processes with different kinds of generally uncertain information,
- The careful handling and use of social dynamics kicked off by this more open governance mode
- The difficult institutional legitimacy of these processes and of their results

Traditional mono-disciplinary approaches as well as regulatory decision-making only contribute partial solutions to this complex problem: Economic approaches treat the optimal size of the deciding, burden-sharing and utilising community (economic theory of federalism) or contribute to a better understanding of costs related to different processes and measures (institutional and welfare economics). They fail to take into account the conditions and factual as well as legal implications of nested decision procedures necessary for multi-level governance. The political sciences focussed for a long time on single-level theoretical concepts of inter-governmentalist or hierarchic supranationalist theories. More modern theories analyse processes of joint-decision making or mutual adjustment, but equally fail to propose holistic improvements considering the four points above.

Analysing and evaluating governance structures of complex environmental systems means integrating research questions from different disciplines, mainly institutional economics and political sciences, but also from law and philosophy, and has to be based on interactive exchange with the natural sciences dealing with the natural resources in question to improve the science/policy interface. With respect to this, different questions fuse: Public participation has been quite high in the CBD process on the global level, but rather low in most European, national and regional decisions on biodiversity protection - Why? What about the science/public and the science/policy interfaces? What do we know about the specificities on each level to be considered? How can we link the different levels, and the different interfaces respecting local and super-local interests and without losing information and legitimacy? Do decision support tools help? A concrete example: How will the natura 2000 network look like once the authorities will have asked for derogations because of overriding general interests? Would a proceeding with more participation have changed the results? In which way?



## Thinking local and of all the users

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**Robert Kenward**, Centre for Ecology and Hydrology and IUCN European Sustainable Use Specialist Group

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**SUMMARY:** Don't forget opportunities for enhancing biodiversity by local activities that don't involve tourism or protected areas, or private income incentives for such activities, or idealism as a motivation for policy efforts.

**KEYWORDS:** Scale, local, incentive-based conservation

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In his message of the 17th November, Rainer Muessner raised the explicit point about the need to tackle policy issues at local scale as well as higher levels, and indirectly raised the issue of who pressures for biodiversity enhancement at local level, mentioning NGOs. These are crucial points if we are to reverse/halt biodiversity loss by 2010.

These points are also especially relevant to the discussion on tourism, where the focus of most contributions has been on costs and benefits of tourism for protected areas (even suggesting that most people in developing countries cannot be tourists).

In the surveys of wildlife-watching participation and expenditure by the US government, two thirds of participation was within 1 mile (1.6 km) of home. Most harvesting of flora and fauna products (which together had much higher value than watching in the US and a recent study by IUCN-UK) would have been within a local area, not after a carbon-costly flight to a distant country. The same would apply even more to people in developing countries, although the National Parks here in Thailand at the IUCN World Conservation Congress also report increased use by nationals as recreational time increases.

In Europe, with a very high proportion of our land in intensive agriculture and forestry, are we to be content to live with a countryside polarised into protected areas (local for only a few people) and intensive use? How about discovering the most cost-effective ways to use local interest in the components of biodiversity to restore pockets and networks of local biodiversity? This is already starting to be done in some countries, but the scope must be huge. Conservation headlands connected in a network can be beneficial for walkers and collectors of diverse wild food plants (who may pay to park their cars nearby), horse-riders (who may pay an access fee), some game-birds (game-use fees), as well as other aspects of biodiversity. How to use such schemes best to restore biodiversity, and thereby show those in developing countries another way than protected areas (sometimes local-people-excluded!) to retain biodiversity?

Such schemes can also add private income as an incentive to pressure from NGOs. In fact, they could with imagination add to rural incomes and employment (e.g. payments to farmers for the results).

PS. Please don't forget that for very large numbers of volunteers (more than 10,000 in various IUCN Commissions) a simple idealistic desire to improve environments can be at least as strong an incentive as career considerations.

## NBPs

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**Carsten Nesshoever**, Department of Conservation Research, UFZ, Leipzig-Halle, Germany

I'd like to generally underline points of Rainer Muessner's last contribution on the role of the NBPs. Since we are just starting to build up our NBP in Germany, I cannot directly answer Rainer's questions, but some additional ideas may be important:

### The role of NBPs

I guess the NBPs may fulfil a role in between many existing structures in the policy-science interface (of course, all these aspects will differ from country to country): NBPs as an interface between science and policy may be able (and have) to tackle some of the incentives we have already discussed:

- They will have to have an active role in informing and guiding scientists towards the policy-relevant topics. From my experience, scientists are well aware of the political questions behind their work, but they don't have (or don't take) the time, to really get into the ongoing discussions- firstly, because it is time-consuming to get informed and secondly, no "easy interfaces" (like this e-conference!) exist to get in direct touch with the discussion. A NBP will thus have the role of informing scientists comprehensively about the latest topics of biodiversity policy (going in the CBD process or on the European level etc). Even this role is time-consuming. In a second step, interfaces at the national level will have to be created and promoted. The NBP must thus be well aware of its "translational" role between science and policy. As Rainer already said the need of a comprehensive communication strategy is central for this.

- An additional communication and integration task for the NBPs is to further integrate between sciences (as one contribution has already stated)- sciences still have to learn from each other about their understanding of biodiversity.

- To policy, the NBP's central role is thus also a role of communication: It has to translate the outcomes from scientific discussions to policy relevant questions. So the role of an NBP is generally a (neutral) communication task and not a scientific one. From my point of view, such a mediation-role on different levels is central for a better communication of biodiversity in all societal groups - and it is a very time-consuming task, of course, and needs to be equipped with several persons working full-time (and not part-time besides doing some research). If these resources are not there, this mediation-role can hardly be covered by an NBP.

### The regional aspect

I guess, for the regional dimension of biodiversity, the ecosystem approach of the CBD already serves as a good frame of work. Of course, scientists may be involved in such processes. But as most of us may know, also on this level mainly communication problems exist between stakeholder groups, as recently outlined in a workshop at Vilm (Korn et al. 2004) To my knowledge, on that level, mediators are sometimes involved in the processes- because one is well aware of the fact that different groups have different languages and interests in the process. Such "mediators" will also be needed on higher levels- as described above for the NBPs.

## **Problems of the Science-Policy Interface**

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**Barbara Gray**, E-Conference Chair, Tias Business School, Tilburg University, The Netherlands

As chair of this e-conference, I am pleased to see the variety of contributions we have received so far. In making these remarks, I would like to “stir the pot” a bit more by encouraging deeper exploration of some of the topics already in play and to encourage others from areas and organizations we haven’t heard from, to offer their views.

Here are a few of my thoughts/queries:

(1) Several suggestions have addressed the need for involvement of actors at the local level. Does anyone have successful examples of how incentives were created for local communities to attend to preserving biodiversity in actions related to development, transportation, framing, etc? If such examples exist, it would be helpful to comment on the reasons for their success and their potential utility in other contexts.

2) Sandra Rientjes suggested that we are all potentially all victims of stereotyping - something few of us enjoy. In what ways might researchers, NGOs and policy makers move beyond stereotyping? How might we critique our own behavior in this regard? Are there any good examples of how this has been done in interactions you have experienced?

3) Regarding consideration of a Council of Scientific Advisers for European Biodiversity Conservation Policy, I have a couple of queries: (A) Before recommending a structural solution (which may indeed have merit), I believe it would be helpful to identify what current problems such a council would try to address? That is, can we explore more fully the concerns that give rise to this solution before we conclude that an “organizational” solution is necessarily the best route to go? (B) Are there any other organizations within the biodiversity community that are already trying to tackle the same issues? If yes, who are they and what has been their experience?

4) Some of the researchers have suggested that part of the problem is that researchers themselves do not necessarily agree. As researchers, what advice can we offer to policy makers to deal with the multitude of disciplinary, methodological and paradigmatic differences that we represent?

5) Can the policy makers who are tuned into this dialogue offer an examples of constructive interactions with the research community in which they were able to deal effectively with the diversity of research approaches?

6) It would be great to hear the perspectives of countries who haven’t yet offered their thoughts and to hear more from policy makers and from NGOS (as well as from more researchers) in order to broaden and deepen our discussion.

## Council of Scientific Advisers for European Biodiversity

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**Frank Wätzold**, UFZ, Leipzig-Halle, Germany

I would like to discuss some topics raised by Barbara Gray in her contribution (problems of science-policy-interface) and other colleagues about the issue of a Council of Scientific Advisers for European Biodiversity Conservation Policy. In this discussion I will refer to the German SRU-Sachverständigenrat für Umweltfragen (The German Advisory Council of the Environment) which in my opinion works very well (an observation confirmed by Rainer Muessner) and gave me the idea to propose a Council of Scientific Advisers for European Biodiversity Conservation Policy. For more information about the SRU see Hey (2005) and [http://www.umweltrat.de/index\\_II.htm](http://www.umweltrat.de/index_II.htm)

What current problems would such a Council try to address?

In my opinion, it should be the task of such a Council to give scientific advice with respect to all relevant questions related to European Union Biodiversity Conservation Policy. That would make it different from national advisory bodies.

Who appoints the members?

The members of the German SRU are appointed by the German Minister of the Environment. This gives them credibility and, so far, has not inhibited the SRU from criticizing the Government if necessary. However, it is a requirement that the Council members are from different disciplines. This composition guarantees an interdisciplinary mode of operation, which especially takes scientific, technological, economic, legal and ethical points of view into account. The members are appointed for a period of four years. European Council may be appointed by DG Environment (to give it credibility) with also an interdisciplinary composition and a similar office term. There have been concerns by Kajetan Perzanowski about a political body to appoint the Council but the German experience suggests that the Ministry of the Environment has an interest in an independent body which gives it scientific support against other Ministries that may be critical of environmental concerns.

What are the advantages of such a Council?

A number of advantages have been named by contributors to this discussion. I would like to highlight one which seems to me of utmost importance. It is the fact that its recommendations may have a very high credibility and visibility. As stressed by Rainer Muessner the recommendations of the German SRU are widely known and well respected in science and policy making. The reasons why they are respected are probably that its members are appointed by the Ministry, they are usually well respected academics and they have not made any “dubious” recommendations so far. The reasons why they are so visible is that the recommendations (a report) are usually accompanied by a press conference and public relation activities. The recommendations of a European Council may possibly get a European-wide coverage in selected newspapers which may also help to promote the issue of biodiversity conservation in the wider public.

## **The role of NBPs in bridging science and policy - an example from Bulgaria**

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**Ana Petrova, Dessislava Dimitrova and Vladimir Vladimirov**, Institute of Botany, Bulgarian Academy of Sciences, Sofia, Bulgaria

Answering Rainer's short questionnaire in support of the preparation of the Dutch colleagues for the launching of their National Platform we felt tempted to share our experience from the short life of the Bulgarian Biodiversity Platform (BBP). Our thoughts are very much in line with the remaining contributions but we try to stress some national peculiarities.

We are still beginners in the challenging job of bridging science and policy, to overcome the opposite stereotypes and overlap the contradicting time frames since the Bulgarian Biodiversity Platform (BBP) was only launched a year ago. Nevertheless, we have gathered some experience and we hope that we have some modest success in bringing science and policy together for the sake of Bulgarian biodiversity. When we started the BBP we initially had to admit that in Bulgaria the interaction of biodiversity science and policy is still a rather weak point. For various reasons the connections were broken some time in the past and the consequences are still present nowadays. However, the situation is improving slowly. The key role of scientists as providers of sound and reliable data for a background of the policy making process is starting to be recognized and biodiversity experts have been invited to participate in advisory bodies to the government (e.g. the National Biodiversity Council to the Minister of Environment and Waters), the development of the national biodiversity related legislation and strategic documents (e.g. Biodiversity Act; Act on the Protected Areas; National Strategy for Biodiversity Conservation and Action Plans, National Biodiversity Monitoring System etc.), realization of key projects on biodiversity conservation (e.g. compilation of National Red Lists, preparation of National Red Data Book, elaboration of the National Biodiversity Monitoring System, elaboration of Management plans of protected areas, including National and Nature parks, gathering of base-line information for elaboration of a Strategy on Invasive Alien Species etc.).

We would argue against establishing a new advisory body in Bulgaria for two reasons basically: 1. We already have such bodies - the National Biodiversity Council to the Minister of Environment and Waters and the National Scientific Coordination Council on Biodiversity to the Bulgarian Academy of Sciences. The problem is how to make the already existing bodies functional and overcome the hindered communication between policy makers and scientists on the one hand, and between biodiversity researchers from different disciplines on the other. Sometimes (unfortunately not very rare) the communication does not go very smoothly or effectively due to the personal characteristics of the scientist or the policy maker, but sometimes, both sides are ready to collaborate but they simply need to learn to listen to and understand each other. 2. In terms of our short experience, the NBP can serve as a medium for the cultivation of such dialogue.

Since its launch, the BBP has been playing an important role in bridging biodiversity science and policy in the country. The BBP initiated important national events like the discussion of the implementation of the Biodiversity Action Plan (1999-2004), elaboration of the new Biodiversity Action Plan (2005-2010), and had an impact on the elaboration of the National Biodiversity Monitoring System through implementation of the CBD, EU and EPBRS documents and achievements.

The main obstacles that hinder a more efficient collaboration in Bulgaria are:

- Poor funding of biodiversity research in Bulgaria from national sources: due to the transition economy science is very poorly funded by the state - little money for commissioned research (the equipment and hence methodologies lack behind compared to the European standards); often scientists are asked to carry out quick and high quality research for very insufficient national funding. Politicians do not always fully understand and respect the specificity of biodiversity research and that often the production of reliable data requires long-term and sometimes expensive studies;

- Discrepancies between urgency of policy needs and the time necessary for high quality biodiversity research: preparing to join the EU in 2007 Bulgaria needs to implement

the EU biodiversity related legislation and requirements in a very short time, which is extremely insufficient for scientists to carry out relevant research and provide all the necessary data;

- Still inefficient communication of the policy needs of the country from the state administration to the biodiversity community in Bulgaria. Bulgaria has ratified and implements most of the biodiversity related acts - Conventions, EU directives, etc. and the necessary focal points and state units do exist. However, maybe due to the overloading with administrative work in the pre-accession process, these state units do not communicate the current achievement and planned activities of the related initiatives to the biodiversity community in Bulgaria in a timely manner.

- Very low salaries: scientific jobs are not attractive especially for the young people - they either leave the country or abandon scientific work;

- Inefficient organization of scientific work in the national biodiversity research centres: enormous amount of data on biodiversity are stored and hosted by research centres but these data are inappropriately organized and difficult to retrieve (reasons: lack of sufficient financial resources and trained staff in the research centres; shortage in national financial support for improving this situation); research plans of scientific institutions need to be adapted to policy needs of the country;

- Underestimated importance of the social functions of scientists: the key role of scientists and scientific work in support of the decision-making process is not fully understood and appreciated in the society, including among politicians;

The key role of the BBP is to help the overcoming the above mentioned constraints and to improve communication between scientists, policy makers, business and NGOs in support of sound decision making and policy relevant research. The process has started but it is still very slow. The BBP can be particularly helpful in:

- Building trustful communication between scientists and policy makers, i.e. scientists understand that one of their obligations is to scientifically support the policy making processes in the country; politicians accept that the most reliable information is produced by scientists;

- Achieving more effective management of the research institutions, transition to a market approach (through discussions, sharing of experience with other similar institutions etc. facilitated by the NBPs);

- Establishment of effective bidirectional link between science and business. Involvement of business in support of biodiversity science and ensure money spent for biodiversity research;

- Achieving effective dissemination of the documents, achievements and the lessons learned from the BioPlatform and EPBRS meetings, and the other NBPs

We think that the continuation of networking like BioPlatform and especially regional collaboration is very important and necessary. Often countries from one and the same region share similar past and therefore similar problems; hence the solutions may be common.

To conclude: our experience with launching the Bulgarian Biodiversity Platform and the subsequent work revealed the following facts:

- Scientists have come up to the conclusion that collaboration makes their work more effective and are willing to cooperate to BBP;

- Policy makers are more ignorant to BBP. They are not always willing to understand the potential impact of such formations. To overcome this situation further efforts are necessary to “push the string”;

- Business has to be specifically addressed, which is one of the major near tasks of BBP.

Key factors for success can be:

- Support of the policy making process through organizing of national meetings, different seminars and workshops at a smaller scale, for example to identify the gaps of biodiversity research in the country, to communicate the EC policy to researchers etc;

- Collaboration of BBP with the national CHM and other NBPs;

- Ensuring sufficient and long-term/sustainable funding for the NBP at national level.

## Discussion observations

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**Barbara Gray**, E-Conference Chair, Tias Business School, Tilburg University, The Netherlands

I would like to offer three observations on the discussion over the last 2 days regarding “What is Biodiversity” and whether species are necessary or sufficient for assessing biodiversity.

First, what appeared initially to be a pointed debate or disagreement in which Alan and Ferdinando were “framing” the problem quite differently eventually led to greater understanding for all of us who were tuned in. This conversation is a good example of how people can talk past (or through) their “frame differences” to achieve greater understanding.

Second, Ben Delbaere reported on a constructive process in which agreement was reached on a preliminary answer to the “What is Biodiversity” question. The process he described sounds like a good model for how consensus can be forged on difficult issues. However, from a process design perspective, even with consensus-building processes like that one, attention also has to be paid to how others who didn’t construct the consensus document can be “brought on board.” In negotiations processes, this is called the “two-table” problem because those negotiators “at the table” face a second negotiation with their constituents back home. Ben mentioned that the political decision about indicators is now being brought back to research experts to show how the indicators can be “underpinned with data.” I am wondering if there is a way that other interested researchers can provide input to that process or at least learn about the results it produces?

Ben can you shed any more light on these issues? The answers seem to be very germane to our topic here. Are there any recommendations that we might want to carry forward from this e-conference about how interested researchers can contribute to those ongoing discussions?

Finally, I would like to share some brief reflections from some successful consensus-building processes in the US. We have had some success with facilitated policy dialogues (sponsored by organizations like the Keystone Centre and the Conservation Foundation who serve as third party conveners). These dialogues typically seat 25-30 stakeholders who (with the help of a skilled facilitator) deliberate about future policy issues extensively over several months with the objective of reaching some consensus recommendations. Because these dialogues are typically held at the national level, if consensus recommendations are reached, these are presented to the Congress, to relevant Federal Agencies, NGOs etc. The Keystone Centre in Keystone, CO has hosted several of these policy dialogues over the years as have other third party organizations.

A second model is what we call “regulatory negotiations.” These are more targeted discussions around a potential regulation that a governmental agency wishes to promulgate. Again, representatives of the relevant stakeholders are convened (by the agency) to formulate a draft regulation. If the group reaches consensus, the regulation is promulgated for review and comment. Technical experts are also often brought in to inform these discussions. The US Environmental Protection Agency has had the most success with this form of policy making.

While these kinds of processes may not solve the problems noted earlier in the e-conference about the long-time horizons needed for collecting new research data to answer policy-makers’ queries, they do offer promising models for improving the science-policy interface. Even if consensus cannot be reached, participants report that greater understanding of each other’s perspectives results from these processes.

Have comparable processes been used for generating biodiversity policy at the country or EU levels in Europe and, if so, with what degree of success? If not, might such processes be useful for enhancing science-policy interaction w/r/t biodiversity?

**RE: Discussion observations**

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**Sybillé Van den Hove**, Institute for Environmental Science and Technology (ICTA), Autonomous University of Barcelona, Spain

A short reaction to Barbara's last message in which she discusses in particular consensus-building processes and their usefulness for enhancing science-policy interaction with regard to biodiversity. I think that what we are looking into here are participatory processes and I prefer to use that terminology as opposed to the consensus terminology. The point is that full consensus is an ideal and, because of the unavoidable existence of an irreducible plurality of values, it is very seldom achievable. Hence participatory approaches should rather be thought on a continuum between consensus-oriented processes in the pursuit of a common interest and compromise-oriented negotiation processes aiming at the adjustment of particular interests. Awareness of this allows avoiding some of the pitfalls of idealistic conceptions of participatory approaches where the negotiation dimension tends to be denied and occulted. In particular, ignoring the negotiation dimension of participatory approaches can impede their legitimacy and effectiveness as learning processes to resolve complex environmental issues beyond the interest of the more powerful actor. We might want to keep this in mind when designing, implementing and assessing participatory science-policy interfaces for biodiversity governance.

**RE: Discussion observations**

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**Ben Delbaere**, ECNC, The Netherlands

In reply to Barbara Gray's question on how interested researchers can provide input into the process of underpinning the EU biodiversity headline indicators with data I here describe this process in a little more detail.

First, the political decision on lists of biodiversity indicators at global and European levels this year was preceded by a long period (started sometime in the mid-nineties) of development in which scientific advice and policy requirements went back and forth between a number of expert working groups and representations of policymakers. These platforms are usually composed of a mix of individuals who represent other groups (scientific institutes, government authorities, NGOs, intergovernmental organisations etc.). When consensus on the indicators was reached, one should assume that all who had been involved in the process to reach this consensus indeed represent larger groups and also feed back to these groups. Obviously many experts and stakeholders will have been missed out, which is inevitable.

In the current stage, described in my previous message, a wide range of stakeholders (same types of groups as listed above) has been invited to take part in the expert groups on the individual indicators. Again, the assumption is that the individuals represent wider stakeholder groups when feeding in their expertise and that they give feedback to these groups. In addition, the work of the groups is presented at various meetings and on the web, allowing a broader group of interested stakeholders to contribute.

**RE: Discussion observations**

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**Angheluta Vadineanu**, Department of Systems Ecology, University of Bucharest, Romania

After reading almost all the contributions to the four complementary subjects regarding biodiversity, I have identified a set of very attractive and interesting ideas and approaches which after further development and integration might help significantly for



operationalisation the policy objectives, like: reduction or halt biodiversity loss; sustainability and so on.

However, the contributions of di Castri, Kitchin, Dick, Weslawski and Gray suggest that is an urgent need to address properly the relationships between Society, Biodiversity and Economy and to increase society relevance of the biodiversity.

Indeed, there is a need to show which are the social and economic implications if the current rate of biodiversity loss is maintained or even increased, versus reduction or halt the rate of biodiversity erosion. Maintaining the current trend of changes in the structure and functioning of biodiversity (broad meaning given by di Castri) or reduction or halting the erosion process, are difficult to be properly understood and integrated into policies and action programmes if we will continue to avoid revealing clear and accountable links between biodiversity and socio-economic systems.

## **Funding questions**

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**Karin Zaunberger**, European Commission, Management of Natural Resources and Services  
- Biodiversity Sector, Brussels, Belgium

How did the science community manage to get so much financial support for the “Human Genome Project” or the Hubble or Swift Burst Alert Telescopes?

How could we get an equivalent amount of money for research on biodiversity?

## **RE: Funding questions**

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**Ferdinando Boero**, DiSTeBA (Dipartimento di Scienze e Tecnologie Biologiche e Ambientali) Universita' di Lecce, Italy

Apparently, I break promises very easily. So here I am again. The question is related to issues I mentioned in one of my innumerable messages. The question, also answered very nicely with the analogy of the trophic pyramid, requires also an answer that deals with the sociology and economics of science.

The human genome project has been sold as the solution to all problems regarding our health. Among others, there are pharmaceutical industries behind. The other two projects, on space exploration, are supported by NASA and by military, rocket-oriented industries. These things are called lobbies. If there is a lobby that has the power to influence politicians, then the funds arrive. If the lobby is not influential, the funds do not arrive, just the little bits that are discarded by others. Medicine and physics take the main share. I can understand medicine, but sometimes physics can be used more to destroy than to build. The amount of money is not unlimited, so if they take the money, we do not have it.

The issue of the Hubble telescope is often mentioned by Robert May, who is (or was) the main scientific advisor of Tony Blair but, in spite of this, he cannot convince funding agencies to stop financing these enterprises and give more money to biodiversity research.

All this falls within the domain of politics, not of policy. We are not a lobby. There are no industries behind us, what we do does not involve enormous expenses that will be used by a restricted group of industrials. These guys elect the President of the United States and then influence his policy. And this influences the rest. The game is too big for us.

Of course we have a lobby too. It is the green movement. But when they succeed in having things like Rio, the scientists are not so happy and try to diverge (I used steal but then I changed the verb) biodiversity money in other directions, while keeping the biodiversity label. And now I should go into the “steering committee” issue that I tackled in another message.

It is suggestive that the question of the 10 million funding was rhetorically posed as an absurd hypothesis, with an absurdly great amount of money for such an issue. Such budgets are peanuts if you launch a rocket on Mars to find little green men. And nobody questions this. Even Hollywood is used to convince people that it is right to search for life on other planets, or to go to Mars anyway. Movies like Contact, Armageddon, Deep Impact (these two speak about the impact of the asteroid, and there is a NASA project to build mega-rockets to shoot the killer asteroid), Mission to Mars, they all contain a message that drives the public opinion towards the acceptance of spending money in this direction. Is it a case? In Armageddon they explicitly speak about the meagre budget of NASA to look for asteroids that might impact our planet!

## **RE: Funding questions**

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**Tim Kitchin**, Glasshouse partnerships

Re funding sources, I remember being struck by a piece in National Geographic recently, outlining the \$billions being spent on shoring up the natural ecosystems of the Missouri(?) basin in order to protect oil supply lines for the US.

Where biodiversity genuinely benefits business, money can be made to flow...  
Equally the prospect of legal liability can be a wonderful way to stir up cash.  
Or human health scares...

### **RE: Funding questions**

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

You say "...the 10 million funding was rhetorically posed as an absurd hypothesis, with an absurdly great amount of money for such an issue. "

In fact I chose this amount because this is more or less the accounting unit that consortia have used for the proposals for "Integrated Projects" and "Networks of Excellence" in the biodiversity work programme in the 6th Framework programme. In other words, projects worth 10 million of the taxpayer's euros are what we are now used to dealing with, no matter how "absurdly great" this amount of money may seem.

I genuinely want to know what could be done for this amount of money, and what people think would be a good investment in biodiversity research at this scale. Why? Because the 7th Framework Programme will also fund IPs and NoEs, and presumably the accounting unit will remain, roughly, 10 million.

### **RE: Funding questions**

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**Alan Feest**, Water and Environmental Management Research Centre, University of Bristol, UK

If we are talking real money then I know what I would do with 10M Euros/pounds/dollars. I would create a database of biodiversity in protected sites and threatened sites across Europe where the information had been collected by a standardised sampling method and provided measured information (numbers!). Only by using data collected in a standardised way are we able determine not only if change has occurred but also the degree of change. The taxonomic groups chosen for this study would not necessarily be the glamorous ones like birds but the one that are either ecosystem keystone organisms (Macrofungi) or sensitive to climate/ecosystem change (spiders, moths, beetles). This scheme would allow re-sampling to take place at later times to determine change and the rate of change. Indicators will not do this no matter how much we might wish they would. Since this would need a great deal of taxonomic expertise and half of the 10M would need to be for training.

As it is now near Christmas should I be asking for this from St Nicholas or the EU?

### **RE: Funding questions**

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**Jan Jansen**, Radboud University Nijmegen, the Netherlands and ICN-Portugal

You point at the right thing. We need a database and we need continuous standardized sampling, based on the best scientific basis.

This means that good fieldworkers should be hired for steady jobs. Good fieldworkers really have affinities with nature! Outside the season they can put info in the data-base. Perhaps I am a little bit impolite here, but I would like to express that some civil servants and other desk workers could just as well work at other organisations.

Of course we need pro-active politicians, civil servants and other desk workers, but without good fieldwork we are nowhere.

So this is a plea to support numerous fieldworkers and a few data-managers.

Alan you talk about protected sites. The Natura 2000 network includes many of the better sites. We have to know what the quality of a site was at the initial start of the designation in order to assess the developments after designation. Do we have these data? Owners of these sites have responsibility, but should not the money to support such monitoring-work be supplied by the authorities anyway?

Only few arthropods are mentioned in the Habitat Directive, macrofungi not at all. There is a lot of work to do.

We really need the politicians and civil servants that can influence national authorities and Brussels to include all kinds of taxa in the assessment of biodiversity quality.

Public awareness and affinity is very important too. We need more movies like “Microcosmos”. During Christmas holidays we can watch them. With such movies you can make money too! Just ask Walt Disney. So what about using the 10M for making a good movie promoting biodiversity and which sells at the same time 100M?

### **RE: Funding questions**

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**Sybille Van den Hove**, Institute for Environmental Science and Technology (ICTA), Autonomous University of Barcelona, Spain

The other lobby power we have is through our consumption and life-style choices. However turning it into an influential (effective) lobby would require that many of us start using this individual lobby power. And that in turn requires people to be aware of, and educated about, the issues and stakes (e.g. what massive biodiversity loss means for humans in the short, medium and long term).

Scientists have an important responsibility here, as they have access to a lot (not all of course) of knowledge that is needed to raise awareness and educate. But how many scientists have the option or the will to dedicate some of their professional time to this task? Where and when are scientists rewarded for such actions? I know of some universities where even the “normal” tasks of teaching undergraduate and graduate students is considered a “mal nécessaire” and only research (and publication) is rewarded...

### **RE: Funding questions**

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**Pedro Fernandes**, Instituto Gulbenkian de Ciencia, Oeiras, Portugal

This is a question that has raised discussions all over the place.

Some projects are so BIG that they easily go over national budgets. And indeed like the space telescopes, particle accelerators, etc. they are not possible without the participation of scientists from several countries, in teams or even in competition.

The OECD, which is a non-governmental body that ultimately was formed using the resources and the spirit of the Marshall plan), is aware of this scale problem and has created a structure called the MegaScience Forum that only addresses scientific problems that are too big for individual governments to consider. Of course, consortiation is the solution but the issue is how to articulate this kind of consortia.

In the specific case of biodiversity, a group was formed in 1995 to address the specific problems of Biodiversity information: how to collect, how to manage, how to distribute it, etc. I have participated in the OECD Working Group on Biodiversity Information as the representative of Portugal. This group has written a report in which the creation of a Global (worldwide) Biodiversity Information Facility is recommended. This has actually happened; you can look at what is being done and how it all started at [www.gbif.org](http://www.gbif.org).

This does not mean that all the research in Biodiversity should be funded this way or anything of the kind. It does not mean either that some people have decided that all the relevant issues in Biodiversity are reduced to information or the informatics behind it.

The truth is that our knowledge in Biodiversity is being wasted because the information is wasted unless something like GBIF is in place.

Think about the many issues I see discussed in this list are open or have no visible solution because Biodiversity research is too disperse and sometimes just invisible. Think of the impact of collecting, organizing and distributing the information that comes out of this research at a planetary scale!

Still on the issue of assessing research problems in Biodiversity via the information generated by the scientific community, let me draw your attention on the BioCASE project that aims at building a specialized information system for biological collection data in Europe. The website is [www.biocase.org](http://www.biocase.org). In this project some standards and procedures have been developed that are of interest for Biodiversity researchers. And the GBIF, described in my previous contribution, is already using the ABCD protocol and other procedures already developed for collection data.

## **A concrete example of a partnership between forest scientists and managers to build a national directive in forest policy**

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**Marion Gosselin**, Cemagref and **Jean-Marc Brézard**, Office National des Forêts, ONF, France

In response to Sandra Rientjes' and Barbara Gray's call for experiences related to the science-policy-interface, we are presenting an example of current cooperation between scientists from the Cemagref (French Institute for Agricultural and Environmental Engineering Research) and forest managers from the Office National des Forêts (French national forest service), initiated to update the ONF national directive concerning biodiversity in managed forests (1993).

Description of the project: The Office National des Forêts intends to update their 1993 national directive concerning biodiversity in managed forests. In this perspective, they will base their work on a recent bibliographic review made by our team on this topic (Gosselin and Laroussinie, Eds, 2004) and make commitments and practical recommendations to foresters. The ONF and the Cemagref will work together to write the new text.

1st step: state-of-the-art management practices. In this step, we will obtain expert advice on the bibliographic review. Our list of experts includes forest managers, ecologists, naturalists, and policy makers. They will be asked the following questions:

- Are the concepts related to biodiversity clearly explained and defined in the document? The objective here is to provide definitions, which would be understandable by both scientists and managers.
- Are there any gaps / misinterpretations in the bibliographic review? The objective here is to check that the most important management and scientific issues concerning biodiversity are dealt with.
- Are the recommendations made by the bibliographic review feasible? How can they be applied? Indeed, some scientific recommendations may be unrealistic or require social science help to be applied (to find new ways of organisation to implement new management rules).
- Are the recommendations compatible with other taxa, which were not systematically taken into account in the review? Since the review principally deals with Flora, Insects and Birds, specialists of other taxa will be solicited within the expert group.

The expert advice will be summarized and serve as a basis for a two-day workshop to debate on recommendations and write a first version of the updated directive.

2nd step: validation. Results of the 1st step work will be presented to the ONF Scientific Committee and then validated by the French Ministry in charge of Forests and Biodiversity. The objective is to publish the new directive in 2006. One of the main objectives is to debate on the recommendations made in the review and to formulate more precise and applied recommendations. Indeed, because results are neither fixed nor consensual, it is difficult for scientists to formulate recommendations. So far, we however recommend the following conclusive remarks to change management practices as well as research practices:

- To avoid purely numeric indices, so that species identities can be taken into account;
- To use ecological groups in data analyses and to give priorities among them (for example forest specialist species) in order to make choices (cf. Alan Feest's contribution from November, 22nd);
- To emphasize most sensitive components of forest biodiversity: forest specialist species; species with limited dispersion capacity; truncated stages in silvicultural cycles and their microhabitats;
- To identify two main groups of objectives: (i) to increase everywhere the mean of some ecological parameters - such as the volume of coarse woody debris density; (ii) at the landscape scale, to increase the variance of other parameters - such as cutting regimes, cutting sizes or stand composition.

Concerning the interaction between scientists and managers, we advocate in the review three levels of increasing interaction:

- To share pieces of knowledge: participation of scientists in the initial or continuing forest training, possibility to alternate scientist or manager positions along the career.
- To monitor biodiversity in current management, in relation with the scientists in order to update indicators or analyses methods
- To develop adaptive management (Walters, 1986), that is to say: to take management questions into account in research projects; to establish management alternatives in order to formulate or test research hypotheses about the mechanisms relating biodiversity and forest management. Adaptive management is a promising framework to protect biodiversity, to enhance partnership between scientists and managers and to avoid too normative solutions.

So far, the initiation of this project was possible:

- Partly by chance, concerning the calendar... The problem of different time frames, pointed out by Frank Wätzold, could have occurred. Indeed, we have the chance that the ONF delayed the updating of the directive, because it took a long time before the bibliographic review was written and edited (almost 5 years!)...
- But also because the scientific bibliographic synthesis was deliberately build on management issues - for example, impact of silvicultural treatments, stand composition, cutting regimes, regeneration and cutting methods, management of first and final stages in the silvicultural cycle and their typical elements (microhabitats, dead wood), recreation.

We think this project will be interesting since we deliberately choose to obtain advice from people from different disciplines: if it works, it will be enriching both humanly and scientifically.

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**RE: A concrete example of a partnership between forest scientists and managers to build a national directive in forest policy**

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**Sybille Van den Hove**, Institute for Environmental Science and Technology (ICTA), Autonomous University of Barcelona, Spain

The process you describe looks quite interesting. I was surprised however not to see any mention of participation of other stakeholders (e.g. NGOs, industry) and the public in the process. Have I missed something? If not, why is it so?

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**RE: A concrete example of a partnership between forest scientists and managers to build a national directive in forest policy**

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**Frédéric Gosselin**, Cemagref, France

I here reply on behalf of Marion Gosselin & Jean-Marc Brézard (since I am not the author of the referred message, but just the sender, and since the two authors will not have the opportunity to answer today).

The first step of the process described by Marion & Jean-Marc concerns the scientist-manager “gradient”: the goal is to reach proposals for a document that are both feasible (from the point of view of managers) and grounded on scientific results. It must be stated that the focus of the final document emerging from this process will mainly be forest managers from the ONF - who manage 26% of French forests -, although the environment of the ONF (Ministries, NGOs, in particular), will be very interested in what is done. The implication of naturalist NGOs is planned for a second phase of the project, when the first directions will be more or less stabilized. I guess that partners of the ONF will also be consulted before adopting this directive, at least in the “Administration Council” (or Administration board) of the ONF.

Finally, it must be recognized that wood industries are not involved in management decisions in France, as is also the case in Scandinavia and Canada. We must also recognize that social scientists and economists are not much involved in the group of experts. From this perspective, we have to improve towards larger interdisciplinarity...



## Some conditions that could promote science/policy interactions

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Frédéric Gosselin, Cemagref, France

My tentative point in this contribution is that interaction between scientists and decision makers will be improved if it centres around (i) shared objectives and language; (ii) a contact with the reality being managed: data; (iii) with the objective of possible future reactions and a common learning; and (iv) in an opened process.

(i) The first point is obvious; it echoes previous contributions to this forum. It in particular implies that scientists do accept that objectives are not only “scientifically” defined, and that decision makers accept the willingness of scientists to define more clearly what is implied by “biodiversity”: the first step is therefore that biodiversity changes in nature from a buzzword to a one on which we can have objectives. This is feasible (cf. contributions by Alan Feest and Ferdinando Boero), although not so simple, and with choices to be made that are not completely scientific.

(ii) The second point is directly linked to this desire of a clearer, more operational definition of biodiversity. We need data to evaluate the policies being implemented, as well as data that could be used in meta-analyses to propose policies (cf. Carsten Nesshoever’s contribution). This is really at the core of the scientific/decision maker collaboration. And I agree with Alan Feest & Ferdinando Boero that data on species abundance of defined taxonomic groups is important in this set of data. If data are not available, I feel that the “natural” reaction of scientists will be to go back to their preferred domain or field of investigation - through lack of appropriation of the policy being implemented. I have already pointed out some directions on this issue in a previous Bioplatform conference (Gosselin, 2002), and many other contributions to this 2002 conference also dealt with this point.

(iii) The third point goes a step further: we surely need to have a thermometer for our European or national biodiversity (cf. point ii); but we should also make efforts to be able to diagnose the disease of biodiversity - if disease there is. To do so, several steps can be taken, among which:

- Collect a priori crucial ecological data together with or in parallel of the biodiversity data mentioned in point (ii). This partly meets the question of indicators of biodiversity (cf. another previous Bioplatform contribution of mine on this point: Gosselin 2004);
- Define policies that acknowledge this point: for instance, when we say our goal is to “stop or significantly reduce the current rate of loss of biodiversity by 2010”, it is a completely different policy to check that this is the case (with data as in point (ii)) or to in addition try to test alternative policies/managements that might help in reversing the trend in case the 2010 target is not met...
- Develop applied research projects that can address particular issues and promote solutions in the future; including future meta-analyses;
- Fix ourselves the objective to learn as much as possible in the following years. This is the central aim of what is called adaptive management (Boorman et al. 1999). Although adaptive management comes with practical difficulties and will surely not solve all the problems, I think it would be worthwhile to apply it in some cases where we anticipate future important choices/evolutions of society demands.

(iv) Adaptive management includes a very open collaboration between scientists, managers and decision makers, and citizens (Boorman et al. 1999). In this respect, it resembles the US “facilitated policy dialogs” mentioned by Barbara Gray, that would be centered on the objective of building new knowledge and in a much longer term. The opening up of the learning process from the scientific sphere to the political/citizen sphere is also, I think, a condition in which scientists -at least some- may involve themselves.

I think these four points should be considered when promoting a better integration between science and decision makers. Points (iii) and (iv) are close to Sybille Van den Hove’s “dynamism” and “participation” requirements - if I interpret them correctly.

**Jaap Wiertz**, RIVM, The Netherlands

### Institutions

The interaction between policy-research will probably highly depend on national circumstances. However examples as in Germany with a temporary board with independent experts (see the contribution of Frank Wätzold) are interesting for more countries. In The Netherlands we have a more or less similar institution: the Environmental Assessment Agency (MNP). This is in fact one of three agencies necessary to cover the three Ps (people, planet, profit) in the debate on the trade off on large political issues. The other two concern 'economics' and 'social-cultural aspects'. The MNP has an independent position, guaranteed by law. MNP is funded by the Ministry of agricultural and the Ministry of Environment, but the MNP make its assessment not specific for these Ministers but for the whole Cabinet and Parliament, so also open for public debate. Every year a 'state of the environment' (and nature) is published and every four years an 'environmental outlook' for the next 15-30 years based on scenario's similar to these of the IPCC. Besides these regular published reports the MNP publish special reports on important current debates in parliament (invited or on its own initiative). These publications are usually discussed in the highest official advisory boards of the government; the cabinet usually publishes a answer on the comments of MNP on the states policy.

### Critical factors in success

Some of the crucial points in success of the Dutch MNP are its independent position, scientific transparency (not the same as ultimate scientific quality!), publishing in time for the political debate, its ability to use and co-operate with a wide network of scientists, civil servants and politicians. MNP developed an interconnected instrumentation of indicators and models in co-operation with other research centres and established monitoring schemes with non-professional field-biologists, state and county authorities. The indicator-concepts (for biodiversity quality and area: National Capital Index) are in line with the discussed concepts of the CBD (Kuala Lumpur 2004) and EU (Malahide 2004). So it is important to seek support and co-operation with other countries e.g. within the EEA in Copenhagen and the ECNC in Paris/Tilburg.

Nature Balance Report 2003 or see also The Natural Capital Index framework (NCI) [www.rivm.nl/en/milieu/natuurbalans\\_verkenning/](http://www.rivm.nl/en/milieu/natuurbalans_verkenning/) EEA / MNP 'Outstanding Environmental Issues' 2004: [www.rivm.nl/bibliotheek/digitaaldepot/OutstandingEnvironmentalIssues.pdf](http://www.rivm.nl/bibliotheek/digitaaldepot/OutstandingEnvironmentalIssues.pdf)

### Successful examples of the interaction between policy-research

One of the most striking examples of good and fruitful interaction are climate (IPCC) and transboundary air pollution especially on acidification ("Convention on Long-Range Transboundary Air Pollution"; CLRTAP 1979; Gothenborg protocol). The latter exemplified an intensive communication between science orientated civil servants and policy orientated researchers, which began with the definition and the awareness of the problem (death of fish in lakes, 'Sterben des Waldes'), financing research programs focused on the ecological explanation of acidification, setting environmental standards, European wide monitoring schemes, and more and more modelling on also biodiversity effects.

## **Species interactions – crucial and usually overlooked part of biodiversity**

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**Al Vrezec**, National Institute of Biology, Ljubljana

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**SUMMARY:** Interactions between species are the main part of biodiversity, although they are rarely present in biodiversity discussions. The author sets out three topics connected to interspecific interactions and biodiversity: (1) interactions in natural communities, (2) interactions with alien species, and (3) interactions of wildlife with human population.

**KEYWORDS:** interspecific interactions, key species, competition, predation, alien species, apparent competition, interaction with humans, public awareness

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Species are the main topic in biodiversity discussion, as we have seen from previous discussions from this conference (see contributions of Alan Feest and Ferdinando Boero), but interactions between them are usually left out from our scope of biodiversity. On the contrary, interactions are one of the main mechanisms that determine species structure in communities and ecosystems, which are number of species and their relative abundances. Here we have to cope with negative interactions (e.g. competition, predation, parasitism), which are better documented in ecological literature, and with positive interactions (e.g. mutualism, commensalism), which are generally less studied and probably underestimated phenomenon. Beside those direct interactions also indirect interactions, e.g. apparent competition, could play very important role in defining which species will survive and which one not. I would like to set out three topics important for understanding the role of interactions in the scope of biodiversity and biodiversity conservation: (1) interactions in natural communities, (2) interactions with alien species, and (3) interactions of wildlife with human population.

Natural communities are structured according to available environmental resources, historical background, and interspecific interactions. In ecological practice, species that have very similar ecological niches, and are therefore in strong negative interactions, e.g. competition, are united in a guild. There are many problems how to determine guild and how to correctly classify right species in the guild. However, our goal in the future should be the identification of guilds, what could be done by increase in knowledge of natural history of species presented in natural communities. Thomas Schoener once pointed three niche dimensions according to which species are segregated: spatial, trophic, and temporal dimension. Those three parameters could therefore be used for such classification. Next step should be identification of key species or competitive dominant species in guilds and communities. I have studied interactions in predator owl guild in montane forests of Slovenia. The guild is composed from three owl species, Ural, Tawny, and Tengmalm's Owl. The results of the study were that beside negative interactions, e.g. interspecific competition and intraguild predation, also positive interactions have very important role in structuring guilds. According to my study I could presume that certain environmental destruction, e.g. fragmentation of forests, that affect key species, in my case Ural Owl, could have much greater consequences than the other human activities, e.g. selective cutting of wood. Management of natural resources use should be therefore dependent on the vulnerability of key species in the ecosystem.

Alien species able to develop self preserving populations, e.g. invasive species, and other alien species, which are preserved by human interventions, e.g. regular introductions, could be a great threat to the natural communities. These species could compete with native species for resources directly, but indirect effects can be even more effective. As an example is a study about apparent competition between alien Ring-necked Pheasant and native Grey Partridge in Europe. Apparently, the direct competitive interactions are not as strong and destructive as indirect parasite-mediated interactions. Shared nematode parasite is developing in Pheasant much better than in Partridge, but has much greater effect on the later. The marked decline of Grey Partridge in Europe is probably due to this indirect apparent competition also, not only to intensive agriculture. Management of biodiversity conservation in regard to alien species should be pointed in studies of interactions between native and alien

species, and in identifying reasons of population decrease of native species. The problem should be addressed also to reintroductions of species in their historical areas. The question is how will reintroduction affect locally established communities?

The last topic is interaction with humans or coexistence of wildlife with human population. In Slovenia this issue was especially set out in connection to large carnivores, e.g. Brown Bear, Wolf, and Lynx, but the problem could be extrapolated also to other for humans “unfavourable” species, for example the Great Cormorant, Raven, Goshawk etc. Large carnivores must be treated as the key species, especially when thinking about their large habitat, waste forest complexes. Conservation of large carnivore’s populations means conservation of their habitat, what is beneficial also for the rest of forest wildlife. The state has very important role in providing the money for recovering damages by large carnivores in agriculture. Another point are threats that large carnivores are presenting to people. In fact, this problem is less common, but very important in facing the problem of large carnivores to the public, especially when regarding reintroductions. People have to learn how to live with large carnivores, and the researchers have to provide persuasive data here. Public awareness is essential!

## Science-policy interface

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**Pedro Fernandes**, Instituto Gulbenkian de Ciencia, Oeiras, Portugal

On obsolete taxonomists: Although it is true that it is more difficult now to attract people to work in taxonomy, especially if we are talking about pure morphologists, it is a mistake to take this to the extreme and conclude that the funding goes only to the ones that have a molecular biology perspective, detached from the rest. The mistake is in failing to understand that what everyone does is to classify information, be it a description (like a specimen record in a museum) or a molecular evolution finding. They are both information and, mind you, they are information about Nature! Mankind needs to make the two approaches converge, i.e. that for example the building on phylogenetic trees is taken fairly as it is (or should always be), joining molecular, morphological, environmental, behavioural etc. information sources to better understand Nature an evolution. Aside of being totally useless, war does not help anyone's cause. As usual.

Names to corpses: if one looks carefully into Species2000, ENBI, GBIF, BioCASE, etc. we all see that names are a very important issue: attributing them to specimens correctly; managing lists where mistakes, redundancies divergence, etc. are ubiquitous; using names lists to standardize the methods, etc. This function is not only recognized but actually praised by the "information" people. If people accept that they can gather around the fact that they are all in a way manipulating information about Nature (does it matter if it is with computers or with pencil and paper or even word of mouth?) then divisionism stops and we all show that we can make good common use of funds at any level, and this means including research in Taxonomy, even if argued this way.

About Investments: Investments in networks of excellence or whatever multi-country structures have shown that it is possible to mobilize national and supra-national efforts, merging them together in organizations that in many cases recognize the above. The funds are no longer captured by a single institute in a big solid stone building. Sponsors are now comfortable about investing in communities, provided that they show a structured, accountable organization. Stepping into this process is not difficult. I would dare to say that it is again a mistake to ignore that these structures exist. It is much cleverer to argue convincingly that these community-based structures are able to host and protect good research multi-country projects in Taxonomy.

"It is true that what Martin says (there is a lot of money to support biodiversity: look at this list of projects) is correct, but it is also true that all these projects (as well argued by one of us) are aimed at providing services (types and lists) and not at producing research." Well, taken broadly this is a way to look at it that requires rethinking. It is true that the result of these projects is seen by some as just lists. This is a consumer perspective that sees the immediate results but not in depth. Lists may be a tip of an iceberg. What is really behind is information integration: the production of new knowledge based on the organization, exploration, mining if you want, of the loads of information that has been piled-up by Mankind during centuries. The opportunity of looking at it in a large scale has been missing for ages and is now in our hands. Scale matters but knowledge crosses its barriers. Being able to interpret Nature is the valuable objective that is pursued, anyway.

"So we need a policy to fund real taxonomy, and not services for non-existing taxonomists." True and untrue. We do need money to fund Taxonomy and taxonomists. We do not need to fund independently any kind of science. Actually, funding science in niches is, in itself, a contradiction. Science is all about understanding, and common grounds have been found around the information issues.

"Martin is right in saying that the EU cannot read our minds." Of course he is. Nobody is going to chase a community and beg for applications. Not the NSF, not the EC, nobody will do it. Likewise no central funding body is going to give more than a message saying that "a priority is recognized in the XX area". GBIF, ENBI and other organizations are perfectly aware of the value of good quality Taxonomy and of the need for professional people to carry it out.

Taxonomists, as many others, produce scientific information. This information is useable to produce more and more scientific knowledge. In my opinion it calls for integration methods. Much in the same way, knowledge about metabolism, for example, is built on biochemistry discoveries, molecular biology findings, clinical trials, etc. So...

## Dealing with pros and cons?

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**Tomas Cerny**, Institute of Botany, Pruhonice, Czech Republic

When we are trying to find solutions about keeping diverse ecosystems, we are debating about administrative issues and hindrances, about the lack of money to fund research and appropriate management, about economic imperative in channelling varied development activities and so on. Very interesting and maybe fundamental notes were made by F. Boero, who has pointed our attention on the role of human nature in making a decision about any future project. In addition, (serious?) problems are emerging in the interplay among scientists and policymakers. In each of these topics, the role of a human being and its profit seems to be ultimate (I am emphasizing this, since we are not discussing the profit of biodiversity to e. g. earthworms, cyanobacteria or flies, however their communities are necessary for life).

So, when we want to solve problems and to cope with a biodiversity dwindle, rather than combat with each other, trying to win discussions with souped-up and highly trimmed arguments, we all have to set “pros and cons” of our decisions. If somebody (organisation, state, EU) wants to build new power plant, highway, ski area, or to restore flood activity of a river and asks for scientists (not only biologists, but their wide forum) to make their opinion, then each report has to contain a list of items, depicting and more deeply explaining, what is the human society gaining by this project and what it is losing. Which of these loses are probably recoverable in the near future, which ones are nearly sure and irreversible and which ones are replaceable by another process or entity. If such answers are very hard to find (because the complexity of factors and processes engaged is immense, and our knowledge is fragmented and insufficient yet), we should recommend to stop that project. If nothing else to add, we should use the rule of precautionary principle. We can work out some argumentation how to convince politicians, that this principle is not only a splash to water line, too simple to believe in it and too effortless to hear it.

For example, when a farmer or any other ground landlord wants to convert several meadow lots to cropland (because the meadows are too small to mow or for grazing, the farmer is lazy to manage them,), he asks competent authority. If the argumentation is based only on the economic rules, the farmer will destroy these meadows (his acquisition from selling sugar beet, maize, wheat etc. is higher than from keeping and breeding several cows, or buying hay, that is uncertain today).

But if the farmer is more educated, or has a positive approach to nature beauty (F. Boero notes) and he has only to solve some temporary problems (threat of financial failure), he is probably standing alone in making a solution (his jack-in-office in a brick house is hardly troubling himself with the biodiversity or nature beauty of some stupid grasslands). And in this model situation a scientist should to come and to say: OK, it is too expensive and laborious for that farmer to manage meadows, and because there are another set of meadows with similar species pool, habitat diversity, without adverse edge effect in the neighbouring countryside, nothing severe will become to our life diversity so the farmer can it plough. Or: Yet it is expensive and laborious, and there is not another farmer or NGO, who could manage these meadows and their habitats are the last ones in a wider landscape, or they are hydrologically important, or they will serve as source for restoration of other degraded or formerly lost meadows, they need to be prevented and further managed.

If there will not be a consensus between recommending scientist and blessing bureaucrat (or between social demands and feasible pros and cons, commonly saying), or if all this will be dependent only on that bureaucrat, with very uncertain quality of his knowledge or common sense, nevertheless powerful, than it would be very complicated, if not impossible, to improve the quality of ecosystems.

## Passing messages

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**Martin Sharman**, Natural Resources Management and Services, Directorate General for Research, European Commission, Brussels, Belgium

How do scientists get the message that some identifiable piece of scientific knowledge is missing from the policy-maker's library of information? This is not a trivial issue at all. Most scientists focus on answering questions that emerge from the scientific world - the world in which the scientific literature points to gaps in our knowledge, or in which the researcher's own exploration stimulates ideas for future research. Few indeed will spend much time thinking about what information might improve the implementation of the Birds or Habitats Directive. And, I suspect, even fewer discuss issues with policy makers to try to identify areas where research would contribute to new policy or policy implementation. Furthermore, it is rarely the case that a policy-maker can formulate an expression of need in such a way that a scientist can easily understand what research must be carried out. An example might be: "if Annex II of the Habitats Directive is not adequate to stop biodiversity loss in Europe, what organisms should be added?" For a scientist, the immediate answer is probably going to be either "here's a list of my pet threatened species" or "hold on, I'm going to have to do some research to answer your question". But what research could possibly answer this question in reasonable time?

We have also been thinking about how the results of the research make their way into the hands of the policy makers. I believe that this is only a small part of the problem of how science gets into policy. Policy makers work in administrations: they are bureaucrats. The form and function of every administration depends on national needs and characteristics, on history, and on the vision of people who have powerful positions in the hierarchy. Each is different, and each works in a different way, and relates in its own way to other institutions in the country. Some are more hierarchical than others, but none work by democracy. In most, thematic issues (and any contact with the scientific world) are the responsibility of desk officers, but they do not make the important decisions, which are typically made by committees or by individuals high in the hierarchy. The way the administration works determines how information reaches those committees or high individuals. Typically, though, information from a desk officer is at best only a small part of the information that contributes to the decision that the fate of any scientific information that finds its way into the decision-making process is uncertain. First, the message has to make its way through the machinery from the desk officer to the desk or committee room where the decision is made. At each step of the way it risks extinction as text is edited and paragraphs shortened. Once in the decision-making room, it finds itself in the company of many other facts, ideas, and hunches, some complementary, some in opposition. Who knows what determines whether that scientific fact will contribute to the policy that is being decided?

## RE: Passing messages

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**Gabor Lovei**, Department of Crop Protection, Danish Institute of Agricultural Science, Slagelse, Denmark

Martin (Sharman) raised an important point. If we want science to influence decision making, scientist have to get involved. How? Devoting time, personal time to the process. It helps if people meet - targeted meetings, for example, geared towards scientists from the respective EU personnel (what do we want from you and how do we work?) would probably work. Maybe it is already happening, but probably needs to be expanded. Many scientists would be willing to aid these decisions but do not know how the mechanism works?

I also believe hierarchical mechanisms only do not work. For example, data useful or the habitat directive can be collected by the respective BirdLife partners and passed through the hierarchical channels. This does not necessarily enable data providers to understand what



is needed, in what form? Perhaps more effort towards the mutual education mechanisms ought to be done.

**RE: Passing messages**

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**Felix Rauschmayer**, UFZ, Leipzig-Halle, Germany

Can we conclude that we need both: information on biodiversity, and information on how this information should be fed into decision processes?

If we would have a funding system where we could produce and collect best information on biodiversity, but the policy input of this would be aleatory, much money would just be wasted. We have to understand how scientific information enters decision processes, (the complementarity of scientific and non-scientific information, the power play of different interests, the difficult normative situation of decision makers between tangible (and pressurized) interests and intangible interests of future generations, the internal structure of administrative processes,...) before we can improve the governance of biodiversity (which in turn is supposed to improve the situation of biodiversity). We should improve it by designing appropriate decision processes, where different kinds of knowledge are processed comprehensibly, where questions of normativity are addressed, where a public debate can influence the decisions. Improving the (quality and) visibility of scientific input as with the German Sachverstaendigenrat fue Umweltfragen may be one of the possible improvements.

Only if scientific input is used efficiently in traceable and legitimate decision processes, enough scientists will give their input, so the design of these processes complements the necessary change of scientific incentive structures claimed by Sybille.

**RE: Passing messages**

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**Robin Moritz**, Institut für Zoologie, Martin-Luther-Universität Halle-Wittenberg, Halle/Saale, Germany

Martin asked: Who knows what determines whether that scientific fact will contribute to the policy that is being decided?

Of course nobody knows what will happen in policy, but equally nobody knows what is a scientific fact. The most dangerous scenario in policy making is if scientific errors are used for policy making. Human history is full of these and they can be devastating (resulting in global wars and other mishaps). What is a scientific fact today in one society may be found to be completely wrong tomorrow in the same society or considered wrong today in a different society.

Can we exclude that in 100 years from now our society (if still existing) pities every penny that has been spent in research on biodiversity conservation or any other topic on the commission's agenda??

Science policy should therefore try to remain as open as possible, support as many disciplines as possible and not try to develop large neither mainstream nor "prestigious" research foci.

Errors and wrong scientific facts are simply unavoidable Robin

## What is a scientific fact?

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**Gabor Lovel**, Department of Crop Protection, Danish Institute of Agricultural Science, Slagelse, Denmark

I dearly wish this forum could be moderated. It is a waste of time to read things such as: “Of course nobody knows what will happen in policy, but equally nobody knows what is a scientific fact. The most dangerous scenario in policy making is if scientific errors are used for policy making. Human history is full of these and they can be devastating (resulting in global wars and other mishaps). What is a scientific fact today in one society may be found to be completely wrong tomorrow in the same society or considered wrong today in a different society. Can we exclude that in 100 years from now our society (if still existing) pities every penny that has been spent in research on biodiversity conservation or any other topic on the commission’s agenda?? Science policy should therefore try to remain as open as possible, support as many disciplines as possible and not try to develop large neither mainstream nor “prestigious” research foci. Errors and wrong scientific facts are simply unavoidable”

But I do not want to let this pass, while wasting still more time:

- It is NOT true that nobody knows what is a scientific fact
- I challenge the writer to come up with an example of a global war that was started due to “scientific errors used for policy making”
- What is a scientific fact (i.e. proven using the scientific method) cannot be found completely wrong in a different society today - the outcome may not be believed or liked by certain people, or even most of those, but this does not alter the facts
- Agreed, we cannot unerringly point to a few areas of biodiversity research priorities, but this should not block us from trying. We cannot study everything with equal intensity, so it is natural and desirable to narrow down to topics that we, on the basis of today’s best evidence, think are most important.
- Errors of judgement are unavoidable, but “wrong scientific facts” are not. Prioritising IS unavoidable. Scientists have to work with policy makers to this end.

Sorry for being blunt.

## Learning from other disciplines

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**Andrew Pullin**, School of Biosciences, The University of Birmingham, UK

I agree with a lot that's been written to this conference, and particularly the letter from Martin Sharman regarding the practicalities of getting the science message across and of policy formers knowing when evidence does or does not exist. But I think it would be sensible for us to consider how the science-policy interface problem has been addressed in other disciplines. Myself and colleagues have been investigating the use of an 'evidence-based framework' to support knowledge transfer from science into policy. Our work is based on the very significant advances that have been made in the health services. To avoid this being a long discourse I suggest colleagues look at a medical website designed to provide scientific evidence to policy makers and practitioners (e.g. [www.cochrane.org](http://www.cochrane.org)) and to have a look at our (very modest) first efforts to create such a service for biodiversity conservation ([www.cebc.bham.ac.uk](http://www.cebc.bham.ac.uk)) and associated refs below. I recommend that this approach should be a subject of debate at the forthcoming EPBRS meeting.

## Summary of priorities

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**Barbara Gray**, E-Conference Chair, Tias Business School, Tilburg University, The Netherlands

The Message from Malahide and the Killarney Declaration set ambitious goals for biodiversity research in support of the 2010 targets. Experience shows, however, that successful interaction and cooperation between research and policy is not unproblematic. Several general priorities related to this topic were identified during the Science/Policy Interface e-conference:

- The need for scientists and policy makers to better understand the way each “frames” the other and to get beyond the stereotypical impressions that often characterize their interactions.
- Facilitation of wide-spread agreement about and dissemination of a scientifically sound and practically-validated definition of biodiversity and the construction of data-backed indicators that can be used as input to policy making.
- The need to find ways to reconcile policy makers’ and NGOs’ needs for “timely” input from researchers with researchers’ need for longer time horizons to plan and conduct valid and reliable research.
- Development of a new cadre of taxonomists and attention to generating and influencing funding to support the development of this career path.
- Development of respected scientific biodiversity databases that can be shared among researchers.
- Interdisciplinary debate among researchers that foster respect for (rather than discrediting of) the variety of legitimate approaches to the study of biodiversity within the research community and may even generate valuable interdisciplinary research.
- Deliberation about the proposed creation of an overarching institution at the EU level to generate scientific recommendations for EU policy makers. The question is whether or not this function is already satisfactorily provided by existing institutions (such as EPBRS, Networks of Excellence, etc.)
- Stimulation of National Biodiversity Fora to bring science and policy together at national levels.
- Educating and influencing local communities and their stakeholders to consider the impact of their land-use decisions on biodiversity.
- The need to develop a variety of highly participative forums that promote rich debate and learning among stakeholders and allow collaborative solutions to emerge through compromise and/or consensus-building.
- The construction of incentives to encourage local communities and particularly developers, transportation agencies and others who are disrupting the landscape to pay attention to the biodiversity impacts of their actions and to find approaches for getting the most cost-effective restoration of terrestrial biodiversity at local levels.
- Increasing the amount of available research EU funds that are directed to biodiversity research (through lobbying, input into the 7th Framework, finding other sources, finding creative ways to engage business in supporting biodiversity research, etc.)
- Consideration of what role scientists can play in enlarging public discussion and awareness of biodiversity issues (especially given the lack of institutional incentives and rewards for such activities by academic researchers).
- Sharing of successful examples/methods for promoting constructive interfaces among biodiversity researchers, NGO’s and policy makers.

## **Concluding comments and appreciation**

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**Barbara Gray**, E-Conference Chair, Tias Business School, Tilburg University, The Netherlands

This message is for everyone who has participated in this e-conference:

We have had an invigorating and far-reaching discussion these last two weeks about numerous aspects of the science/policy interface. The conversation suggests that you all are working in a highly complex domain whose multiple constituents are characterized by considerable diversity in scientific disciplines, methodologies, relevant audiences, reward and incentive structures, time frames, levels of influence (local, national, EU, global), priorities, not to mention personal persuasions. In addition, the biodiversity domain is fraught with uncertainty which complicates research and policymaking tremendously.

Nonetheless, several constructive threads of conversation were initiated and we began a rich exploration of them. In the list of priorities posted earlier today I tried to capture the common themes that seemed to be emerging as well as some of the debate that we enjoyed over several of the topics. That was a “first draft” list which I expect to refine over the next several days and develop into recommendations for you to consider further at the EPBRS conference in Amsterdam. Many of you were more eloquent in your presentation of these ideas than I can be, so I hope you will feel comfortable if I “borrow” some of the phraseology from various emails as I fine tune the recommendations and the accompanying report.

You all have a challenging task ahead of you not only substantively but also in terms of continuing to support a constructive dialogue. Looking back over our conversation, it is easy to see how we can slip on the blinders that originate from our disciplinary or organizational homes--blinders that write others in less than respectful terms and cause us to become strident in our own presentation. I must say that I was pleased at how everyone purported themselves during this e-conversation and I want to commend you for that. The conversation was both frank, but respectful. I hope this spirit of interaction will continue when we meet in Amsterdam on December 10th.



## References

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- Bardsley, D. & Edwards-Jones, G. 2004. Stakeholders' perceptions of the impacts of invasive exotic plant species in the Mediterranean region. *GeoJournal*, In Press.
- Baskin, Y. 2002. *A Plague of Rats and Rubbervines: The Growing Threat of Species Invasions*. Island Press, Washington D.C.
- Begon, M., Harper, J.L. & Townsend, C.R. 1996. *Ecology - individuals, populations and communities*. 3rd ed., Blackwell Science, London.
- Biosphere reserve Tara. 2003. Institute for Nature Protection of Serbia, Belgrade.
- Bobbink, R., Hornung, M. & Roelofs, J.G.M. 1996. Empirical nitrogen critical loads for natural en semi-natural ecosystems. Manual on methodologies and criteria for mapping critical levels/loads and geographical areas where they are exceeded. UN/ECE Convention On Long-range transboundary Air pollution. Federal Environment agency, Berlin.
- Bonsall, M.B. & Hassell, M.P. 1997. Apparent competition structures ecological assemblages. *Nature* 388: 371-373.
- Borges, P. A. V. & Brown, V. K. 1999. Effect of island geological age on the arthropod species richness of Azorean pastures. *Biological Journal of the Linnean Society* 66: 373-410.
- Borges, P. A. V., Serrano, A. R. M. & Quartau, J. A. 2000. Ranking the Azorean Natural Forest Reserves for conservation using their endemic arthropods. *Journal of Insect Conservation* 4: 129-147.
- Borges, P.A.V., Aguiar, C., Amaral, J., Amorim, I.R., André, G., Arraiol, A., Baz A., Dinis, F., Enghoff, H., Gaspar, C., Ilharco, F., Mahnert, V., Melo, C., Pereira, F., Quartau, J.A., Ribeiro, S., Ribes, J., Serrano, A.R.M., Sousa, A.B., Strassen, R.Z., Vieira, L., Vieira, V., Vitorino, A. and Wunderlich, J. Ranking protected areas in the Azores using standardized sampling of soil epigeal arthropods. *Biodiversity and Conservation*. In press.
- Borges, P.A.V., Lobo, J.M., Azevedo, E. B., Gaspar, C., Melo, C. & Nunes, L.V. Relating fine-scale species richness spatial distribution of island (Azores) arthropods with environmental variables: a general model of endemic vs. exotic species. *Journal of Biogeography*. Submitted.
- Bormann, B.T., Martin, J.R., Wagner, G.H., Wood, G.W., Algeria, J., Cunningham, P.G., Brookes, M.H., Friesema, P., Berg, J. & Henshaw, J.R. 1999. Adaptive management. In: Sexton W.T., Malk, A.J., Szaro, R.C. & Johnson, N.C. (Eds), *Ecological stewardship. A common reference for ecosystem management*, pp 505-534, Elsevier, Oxford.
- Bright, C. 1999. *Life Out of Bounds: Bio-invasions in a Borderless World*. Earthscan Publications, London.

- Broad, S., Mulliken, T. & Roe, D. 2003. The nature and extent of legal and illegal trade in wildlife. In: Oldfield, S. (ed.), The trade in wildlife. Regulation for conservation. Earthscan Publications Ltd.
- Bromley, P. 1997. Nature Conservation in Europe: Policy and Practice. E&FN Spon, London.
- Buckley, R.C. (ed.) 2004. Environmental Impacts of Ecotourism. CABI, Oxford.
- Buckley, R.C. 2002. Tourism and biodiversity in North and South. *Tourism Recreation Research* 27 (1): 43-51.
- Buckley, R.C. 2003. Case Studies in Ecotourism. CAB International Oxford.
- CCE, 2001. From Critical Loads to Dynamic Modelling. In: Modelling and mapping of Critical Thresholds in Europe. Status Report 2001. Coordination Center for Effects. RIVM report 259101010. RIVM, Bilthoven.
- Ceballos-Lascurain, H. & Hitesh, M. 2002. Architectural Design. In: Hitesh, M. (ed.), International Ecotourism Guidelines. The International Ecotourism Society. Burlington, VT, US.
- Ceballos-Lascurain, H. 1996. Tourism, Ecotourism and Protected Areas. IUCN. The World Conservation Union. Gland, Switzerland.
- Ceballos-Lascurain, H. 1997. Ecotourism Guidelines for the Red Sea Coast of Egypt. Report to Winrock Organization. Washington, DC, USA.
- Ceballos-Lascurain, H. 2001. Integrating Biodiversity into the Tourism Sector: Best Practice and Country Case Studies. Study for the United Nations Environment Programme (UNEP/UNDP/ GEF/BPSP). Nairobi.
- Chaloupka, M., 2002. Stochastic simulation modelling of southern Great Barrier Reef green turtle population dynamics, *Ecological Modelling* 148: 79-109.
- Conservation International, 2003. Tourism and Biodiversity: Mapping Tourism's Global Footprint. [www.conservation.org](http://www.conservation.org) and [www.uneptie.org](http://www.uneptie.org)
- Corti, C., Böhme, W., Delfino, M. & Masseti, M. 1999. Man and Lacertids on the Mediterranean Islands: Conservation perspectives. *Nat. Croat.* 8 (3): 287-300.
- Corti, C., Masseti, M., Delfino, M. & Perez-Mellado, V. 1999. Man and herpetofauna of the Mediterranean islands. *Rev. Esp. Herp.* 13: 83-100.
- Council of Europe. 1997a. Recommendation N. R (97) 9, of the Committee of Ministers to Member States on a Policy for the Development of Sustainable Environment-Friendly Tourism in Coastal Areas, <http://www.coe.fr/cm/ta/rec/1997/97r9.html>
- Council of Europe. 1997b. Tourism and Environment, Questions and Answers, n.3.
- Cronk, Q.C.B. & Fuller, J.L. 2001. Plant Invaders: The Threat to Natural Ecosystems. Earthscan, London.
- Damanakis, M. 1976. Control of *Oxalis pes-caprae* L. with pre-emergence and post-emergence treatments. Proceedings of the 1976 British Crop Protection Conference: Weeds 1: 321-327.
- di Castri, F. & Balaji, V. (eds.). 2002. Tourism, Biodiversity and Information. Backhuys Publishers, Leiden.
- Di Tomaso, J.M. 2000. Invasive weeds in rangelands: species, impacts, and management. *Weed Science* 48: 255-265.
- Diemont, H. & Jansen, J. 2004. Open mountainous versus lowland landscapes. The case of West-European landscapes. In:
- du Toit, J., Walker, B., & Campbell, B. 2004. Conserving tropical nature: current challenges for ecologists. *Trends in Ecology and Evolution* 19: 12-17.
- Edwards, K.R. 1998. A critique of the general approach to invasive plant species. In: Starfinger, U., Edwards, K., Kowarik, I. & Williamson, M. (eds.), Plant Invasions: Ecological Mechanisms and Human Responses, pp. 85-94, Backhuys, Leiden.
- Funtowicz, S. & Ravetz, J. 1993. Science for the Post-Normal Age. *Futures*, 25 (7): 735-755.
- Funtowicz, S. 2001. Peer Review and Quality Control, in: International Encyclopaedia of the Social and Behavioural Sciences, pp 11179-83. Elsevier.
- Gaston, K. 2000. Global patterns in biodiversity. *Nature* 405: 220-227.
- Gherardi, F. & Holdich, D.M. (eds.). 1999. Crayfish in Europe as alien species. How to make the best of a bad situation? Balkema, Crustacean Issues, Vol. II, Rotterdam.

- Reynolds, J.D. & Souty-Grosset, C. (eds.). 2003. The endangered native crayfish *Austropotamobius pallipes*, bioindicator and heritage species. Bull. Fr. Peche Piscic. No.370-371, 230p.
- Giurgiu, V. & al. 2001. Padurile virgine din Romania, pp. 204, Asbl Foret Wallonne.
- Gosselin, F. 2002. Towards biodiversity monitoring at the European scale - proposal of principles and discussion of examples, Electronic Conference, [www.gencat.net/mediamb/bioplatform/bd\\_70.htm](http://www.gencat.net/mediamb/bioplatform/bd_70.htm)
- Gosselin, M. & Laroussinie, O. (eds.). 2004. Gestion Forestière et Biodiversité : connaître pour préserver - synthèse bibliographique, Antony, Cemagref Editions.
- Gosselin, F. 2004. Brief considerations on the relative merits of direct monitoring and indicators of biodiversity, [www.nbu.ac.uk/biota/Archive\\_livelihoods/5587.htm](http://www.nbu.ac.uk/biota/Archive_livelihoods/5587.htm)
- Grosholz, E. 2002. Ecological and evolutionary consequences of coastal invasions. Trends in Ecology & Evolution 17: 22-27.
- Grove, A.T. & Rackham, O. 2001. The Nature of Mediterranean Europe: An Ecological History. Yale University Press, New Haven.
- Hawkins, D.E. et al. 1995. The Ecolodge Sourcebook. The International Ecotourism Society (TIES). Burlington, VT, US.
- Hawkins, D.E. et al. 2003. Energy, water, and broad-scale geographic patterns of species richness. Ecology 84: 3105-3117.
- Hepell, S.S., Crowder, L.B., Crouse, D.T., Epperly, S.P., & Frazer, N.B. 2004. Population models for the Atlantic loggerhead. In: Bolten, A.B., & Witherington, B.E.(eds.), Loggerhead sea turtles, pp 255-274, Smithsonian Books, Washington.
- Hettinger, N. 2001. Exotic species: naturalization, and biological nativism. Environmental Values 10: 193-224.
- Hey, C. 2005. Umweltberatung und Politik: Das Beispiel des Sachverständigenrates für Umweltfragen. In: Hansjürgens, B. & Wätzold, F. (eds.), Zeitschrift für angewandte Umweltforschung, Sonderheft: Bilanz und Perspektiven der Umweltpolitik und der umweltökonomischen Politikberatung.
- Hulme, P.E. 2004. Invasions, islands and impacts: A Mediterranean perspective. In: Fernandez Palacios, J.M. (ed.), Island Ecology, pp 337-361, Asociación Española de Ecología Terrestre, La Laguna, Spain.
- Humphries, S.E., Groves, R.H. & Mitchell, D.S. 1991. Plant invasions of Australian ecosystems: a status review and management directions. In Australian National Parks and Wildlife Service (ed.), Plant Invasions: The Incidence of Environmental Weeds in Australia, pp 1-127, Commonwealth of Australia, Canberra.
- Jaksic, F.M. 1981. Abuse and misuse of the term "guild" in ecological studies. Oikos 37: 397-400.
- Jansen, J. & Diemont, H. 2004. Prospects of the open Atlantic mountain landscape of Europe at its southwestern limit: the possible role of heathland-based farming in achieving EU Directives in the Serra da Estrela. In: Bunce, B., Howard, D. & Pinto Correia, T. (eds.), Landscape Ecology Series, IALE, UK. Submitted.
- Jansen, J. 2002. Geobotanical guide of the Serra da Estrela. Instituto da Conservação da Natureza. Ministério das Cidades, Ordenamento do Território e Ambiente. Lisboa.
- Jenkins, P.T. 1999. Trade and exotic species introductions. In Sandlund O.T., Schei P.J. & Viken Å. (eds.), Invasive Species and Biodiversity Management, pp 229-235, Kluwer Academic, Dordrecht.
- Jepson, P. & Canney, S. 2003. Values-led conservation, Global Ecology and Biogeography 12: 271-274.
- Kaimowitz, D., Angelsen, A. 1998. Economic models of tropical deforestation: a review. Centre for International Forestry Research. Bogor, Indonesia.
- Kay et al. 1999. An ecosystem approach for sustainability: addressing the challenge of complexity. Futures 31: 721-742.
- Kendle, A.D. & Rose, J.E. 2000. The aliens have landed! What are the justifications for 'native only' policies in landscape plantings? Landscape and Urban Planning 47: 19-31.



- Korn, H., Schliep, R., Stadler, J. 2004. Report on the international workshop on ways to promote the ideas behind the CBD's Ecosystem Approach in Central and Eastern Europe. BfN-Schriften 120: 133 pp. (online at: <http://www.biodiv-chm.de/Documents/Ecosystem-Approach-CEE-2004>)
- Kousis, M. & Lekakis, J.N. 2001. The Europeanisation of Environmental Policy in Greece. Europeanisation of Environmental Policy Workshop: 29th June – 1st July 2001, Cambridge UK.
- Krystufek, B., Flajsman, B. & Griffiths, H.I. 2003. Living with Bears. A Large European Carnivore in a Shrinking World. Ecological Form of the Liberal Democracy of Slovenia, Ljubljana.
- Lavorel, S. 1999. Ecological diversity and the resilience of Mediterranean vegetation to disturbance. *Diversity and Distributions* 5: 3-13.
- Mack, R.N., Simberloff, D., Lonsdale, W.M., Evans, H., Clout, M. & Bazzaz, F.A. 2000. Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications* 10: 689-710.
- Máñez-Costa, M.A. 2003. Strategien und Optionen für den Natur und Umweltschutz in agrarischen Produktionssystema - Ein Fallbeispiel aus Guatemala. *Treffpunkt Biologische Vielfalt III*: 213-219.
- Máñez-Costa, M.A., Renner, S.C. 2004. Direct payments for conservation - the importance of environmental measures in farming systems for bird populations in a fragmented landscape. A case study in Guatemala. In: Marggraf, M. (ed.), *Valuation and Conservation of Biodiversity*, Springer, Berlin.
- Marshall, G. 1987. A review of the biology and control of selected weed species in the genus *Oxalis*: *O. stricta* L., *O. latifolia* H.B.K. and *O. pes-caprae* L. *Crop Protection* 6: 355-364.
- Marzetti, S. & Mosetti, R. 2003. Sustainable tourism development and social carrying capacity: a case-study on the North-Western Adriatic Sea. In: Pineda, E.D. & Brebbia, C.A. (eds.), *Sustainable Tourism*, pp. 211-220, WITPRESS, Southampton.
- Mazaris, A. D., Kornaraki, L., Matsinos, Y.G., Margaritoulis, D. 2004. Effects of climatic factors upon sea turtle emerge and successful nesting attempts: Empirical modelling of seasonal trends. *Natural Resource Modelling* 17: 445-466.
- McNeely, J.A. 2000. The future of alien invasive species: changing social views. In: Mooney, H.A. & Hobbs, R.J. (eds.), *Invasive Species in a Changing World*, pp 171-189, Island Press, Washington D.C.
- McNeely, J.A., Mooney, H.A., Neville, L.E., Johan Schei, P. & Waage, J.K. 2001. *Global Strategy on Invasive Alien Species*. IUCN, Gland.
- Médail, F. & Quézel, P. 1997. Hot-spots analysis for conservation of plant biodiversity in the Mediterranean basin. *Annals of the Missouri Botanical Gardens* 84: 112-127.
- Mehta, H. & Ceballos-Lascurain, H. 2002. Site Selection, Planning and Design. In: Hitesh, M. (ed.), *International Ecotourism Guidelines*, The International Ecotourism Society, Burlington, VT, US.
- Mihăilescu, S. & Falcă, M. (eds.). *BIOPLATFORM – Romanian National Platform for Biodiversity*, vol. I Biodiversity research strategy, p. 130, Ed. Vergiliu, Bucharest.
- Miller, D. J. 1997. Reproduction in sea turtles. In: Lutz, P. L., & Musick, J. A. (eds.), *The biology of sea turtles*, pp 51-83, CRC Press, Boca Raton.
- New York Times. 21/9/2004. Second Thoughts for a Designer of Software That Aids Conservation [www.bren.ucsb.edu/news/press/GreatBarrierReef\\_NYTimes\\_9-21-04.htm](http://www.bren.ucsb.edu/news/press/GreatBarrierReef_NYTimes_9-21-04.htm)
- Nilsson, J. & Grennfelt, P. (eds.). 1988. Critical loads for sulphur and nitrogen. Miljø rapport 1988 15. Nordic Council of Ministers, Copenhagen, Denmark.
- O'Connor, M. 1999. Dialogue and Debate in a Post-Normal Practice of Science: A Reflection. *Futures* 31: 671-687.
- Office national des forêts. 1993. *Prise en compte de la diversité biologique dans l'aménagement et la gestion forestière*. Instruction, Paris, Office national des forêts.

- Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V., Mihailescu, Simona. 1994. Lista Rosie a plantelor superioare din Romania (Red List of higher plants from Romania). Institutul de Biologie - Studii, Sinteze, documentatii de ecologie, 1: 1-52, Bucuresti.
- Oreskes, N. 2004. Science and public policy: What's proof got to do with it? *Environmental Science and Policy* 7: 369-383.
- Petty, S.J., Anderson, D.I.K., Davison, M., Little, B., Sherratt, T.N., Thomas, C.J. & Lambin, X. 2003. The decline of Common Kestrels *Falco tinnunculus* in a forest area of northern England: the role of predation by Northern Goshawks *Accipiter gentiles*. *Ibis* 145: 472-483.
- Pimental, D., McNair, S., Janecka, J., Wightman, J., Simmonds, C., O'Connell, C., Wong, E., Russel, L., Zern, J., Aquino, T. & Tsomondo, T. 2001. Economic and environmental threats of alien plant, animal, and microbe invasions. *Agriculture, Ecosystems and Environment* 84: 1-20.
- Preston, C.D., Pearman, D.A. & Dines, T. 2002. *The New Atlas of the British Flora*. Oxford University Press, U.K.
- Pullin, A.S. & Knight, T.M. 2001. Effectiveness in Conservation Practice: Pointers from Medicine and Public Health. *Conservation Biology*, 15, 50-54.
- Pullin, A.S. & Knight, T.M. 2003. Support for decision making in conservation practice: an evidence-based approach. *Journal of Nature Conservation*, 11, 83-90.
- Pullin, A.S., Knight, T.M., Stone, D.A. & Charman, K. 2004. Do conservation managers use scientific evidence to support their decision-making? *Biological Conservation* 119, 245-252.
- Radovic, D. 2004. Master thesis; The Assessment and Protection of Natural Values of NP Tara by evolving GIS Technology. Belgrade.
- Randerson, J. 2004. Should governments play politics with Science?. *New Scientist* 9, 12-14.
- Reid, W.V. & Mace, G.M. 2003. Taking Conservation Biology to new levels in Environmental Decision-Making. *Conservation Biology* 17 (4): 943-945
- Renner, S.C. 2003. Structure and diversity of cloud forest bird communities in Alta Verapaz, Guatemala, and implications for conservation. *Niedersächsische Staats- und Universitätsbibliothek, Göttingen*.
- Ribeiro, S.P., Borges, P.A.V., Gaspar, C., Melo, C., Serrano, A.R.M., Amaral, J., Aguiar, C., André and Quartau, J.A. Canopy insect herbivore diversity and distribution in the native forests of the Azores: key host plant species in a highly generalist insect community. *Ecography*. In press.
- Rientjes, S. (ed.). 2000. *Communicating Nature Conservation*. ECNC Publication technical report series.
- Sala, O.E., Chapin, F. S., Armesto, J. J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald E. et al. 2000. Biodiversity - Global biodiversity scenarios for the year 2100. *Science* 287:1770-1774.
- Salafsky, N., Margoluis, R., & Redford, K. *Adaptive Management: A Tool for Conservation Practitioners*. Washington, D.C.: Biodiversity Support Program.
- Schoener, T. 1974. Resource Partitioning in Ecological Communities. *Science* 185: 27-39.
- Scoones (eds.). *Negotiating Environmental Change. New Perspectives from Social Science*, Edward Elgar, Cheltenham.
- Seidl, I. & Tisdell, C.A. 1999. Carrying capacity reconsidered: from Malthus' population theory to cultural carrying capacity. *Ecological Economics* 31: 395-408.
- Sharman, M. & van den Hove, S. Interfaces between Science and Policy for Environmental Governance: Lessons and open questions from the European Platform for Biodiversity Research Strategy. In: Guimaraes Pereira, A. (ed.) *Interfaces between Science and Society*. Forthcoming.
- Shine, C., Williams, N. & Gündling, L. 2000. *A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species*. IUCN, Gland.
- Spatial Plan of National Park Tara. 1989. Official messenger of Socialist Republic of Serbia, No 3/89. Belgrade.

- Stedman, R.C. 2003. Is it really just a social construction? The contribution of the physical environment to sense of place. *Society and Natural Resources* 16: 671-685.
- Stevanovi, V. 2002. Phytogeographical Position and General Review of Flora and Vegetation of Tara Mountain, 4-7, Proceedings, XXV Convention about Medicinal Herbs and Aromatic Plants, Bajina Basta.
- Stirling, A. 1999. On 'Science' and 'Precaution' in the Management of Technological Risk, report to the EU Forward Studies Unit, IPTS, Sevilla, EUR19056 EN.
- Stirling, A. 2003. Risk, Uncertainty and Precaution: Some Instrumental Implications from the Social Sciences. In: F. Berkhout, M. Leach and I.
- Stolpe, G. & Fischer, W. (eds.) 2004. Promoting CITES-CBD Cooperation and Synergy Proceedings of the Workshop 20-24 April 2004, Isle of Vilm, Germany. Bundesamt für Naturschutz (BfN). Available for downloading at [www.bfn.de/en/09/090203](http://www.bfn.de/en/09/090203)
- Straaten, J. van der. 2004. Protection of biodiversity in Europe. 4th PAN workshop on vulnerability and resilience of cultural landscapes, zie <http://pan.cultland.org/>
- Sutherland, W.J., Pullin, A.S., Dolman, P.M. & Knight, T.M. 2004. The need for evidence-based conservation. *Trends in Ecology and Evolution* 19: 305-308.
- Terborgh, J. 1999. *Requiem for nature*. Island Press, Washington DC.
- Thiele, F. 2004. Mistress and Handmaiden: Scientific Policy consulting between Science and Politics. *European Academy, Newsletter, Akademie-Brief No. 46: 1-3*.
- Tompkins, D.M., Greenman, J.V., Robertson, P.A. & Hudson, P.J. 2000. The role of shared parasites in the exclusion of wildlife hosts: *Heterakis gallinarum* in ring-necked pheasant and the grey partridge. *Journal of Animal Ecology* 69: 829-840.
- Turland, N.J., Chilton, L. & Press, J.R. 1993. *Flora of the Cretan Area*. Natural History Museum, London.
- UN. 2003. *Erosion of the Mediterranean Coastline: Implications for Tourism*. Parliamentary Assembly Report. United Nations Committee on Economic Affairs and Development. Doc 9981
- van den Hove, S. 2000. Participatory approaches to environmental policy-making: the European Commission Climate Policy Process as a case study. *Ecological Economics* 33: 457-472.
- van den Hove, S. 2004. Between consensus and compromise: acknowledging the negotiation dimension in participatory approaches. *Land Use Policy*, in press.
- Vitousek, P. M. 1988. Diversity and biological invasions of oceanic islands. In: Wilson, E. O. (ed.), *Biodiversity*, pp 181-189, National Academy of Science, U.S.A.
- Vrezec, A. & Tome, D. Habitat selection and patterns of distribution in a hierarchic forest owl guild. *Ornis Fennica* 81. In print.
- Wadsworth, R. & Treweek, J. 1999. *Geographical Information Systems for Ecology: An Introduction*. Longman, London.
- Walters, C.J. 1986. *Adaptive management of renewable resources*. Mac Millan, New York.
- Williams, C.E. 1997. Potential valuable ecological functions of non-indigenous plants. In: Luken, J.O. & Thieret, J.W. (eds.), *Assessment and Management of Plant Invasions*, pp 26-34, Springer-Verlag, New York.
- Wittenberg, R. & Cock, M.J.W. 2001. *Invasive Alien Species: A Toolkit of Best Prevention and Management Practices*. CAB International, Wallingford, UK.
- World Travel and Tourism Council. 2002. *Corporate Social Responsibility*. London, UK.
- WTO. 2002. *Tourism Statistics*. Last accessed August 2003.
- WTO. 2004. *World Tourism Barometer*. April 2004. World Tourism Organization official web site: Site accessed 14 Nov 2003 WTTC.
- WTTC. 2000. *Update on World Tourism*. World Travel and Tourism Council. Brussels, Belgium.
- Wynne, B. 1992. Uncertainty and Environmental learning. *Reconceiving science and policy in the preventive paradigm*. *Global Environmental Change* 6: 111-127.

Younis, E. 2000. Tourism Sustainability and Market Competitiveness in the Coastal Areas and Islands of the Mediterranean. In: Sustainable Travel and Tourism, pp 65-67, ICG Publishing Ltd, UK.