Proceedings and conclusions of the ReNED Conference

Ecosystem Services and Biodiversity in Developing Countries

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Preface and acknowledgements

These proceedings present the background and objectives of the ReNED conference entitled “Ecosystem Services and Biodiversity in Developing Countries” held in August 2005, and provide an overview of the papers presented and the discussions and conclusions of the conference.

The topic of the conference was suggested by a group of ReNED members. ReNED would like to thank the organising committee, which took up the challenge and hard work of developing a full conference proposal and organising the conference: Elmer Topp-Jørgensen, NORDECO; Gabor Lövei, Danish Institute of Agricultural Sciences; Helle Munk Ravnborg, Danish Institute of International Studies; Ivan Nielsen, Department of Biology, University of Aarhus; Michael Køie Poulsen, NORDECO; Niels Elmegaard, National Environmental Research Institute; Sten Struwe, Institute of Biology, University of Copenhagen; Thomas Kristensen, DBL – Institute for Health Research and Development.

We are also grateful to the speakers, who contributed with stimulating presentations leading to a successful and productive meeting. These included opening addresses by Chief Technical Advisor, Henning Nøhr, Ministry of Foreign Affairs and Ivan Nielsen, Department of Biology, University of Aarhus; key note speeches by Belinda Reyers, CSIR Environmentek, South Africa; Phyllis D. Coley and Thomas A. Kursar, Department of Biology, University of Utah, USA; Jon Fjeldsaa, Natural History Museum, University of Copenhagen; and Subhrendu K. Pattanayak, Research Triangle Institute, USA; and plenary and parallel session presentations by Neil Burgess, Department of Zoology, Cambridge University, UK; Donald Macintosh, Centre for Tropical Ecosystems Research, University of Aarhus; Jacobien Scherpbier-van Holthe, WHO Consultant, France; Gabor Lövei, Danish Institute of Agricultural Sciences; Henrik Egelyng, Danish Institute of International Studies; Tom Blomley, Forestry and Beekeeping Division, Tanzania; Hugo Navarrete, Universidad P. Catolica, Ecuador; and Ivan Nielsen, Department of Biology, University of Aarhus; Sanit Aksornkoe, Thailand Environment Institute; Nguyen Giang Thu, Ministry of Fisheries, Vietnam; John Massao, Forest and Bee Keeping Division, Tanzania; Kirsten Ewers, Rambøll, Denmark; John Balarin, Danish Hunters Association, Southeast Africa CBNRM Wildlife Program, Malawi; and Niels Elmegaard, National Environmental Research Institute, Denmark.

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Finally, we would like to acknowledge the Royal Danish Ministry of Foreign Affairs for kindly providing funding for the conference through the ReNED grant.

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List of abbreviations

CBD	Convention on Biological Diversity
CBNRM	Community Based Natural Resource Management
CGIAR	Consultative Group on International Agricultural Research
CPWF	Challenge Program for Water and Food
DANIDA	Danish International Development Assistance
DfID	Department for International Development (UK)
EC	European Commission
EIA	Environmental Impact Assessment
ENRECA	Enhancement of Research Capacity (Danida)
EU	European Union
FR	Forest Reserve
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIS	Geographical Information System
GM	Genetically Modified
HAP	Habitat Action Planning
ICBG	International Cooperative Biodiversity Groups
IFM	Institute of Fisheries Management and Coastal Community Development
IPM	Integrated Pest Management
IUCN	The World Conservation Union
LMB	Lower Mekong Basin
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
MPA	Marine Protected Area
MRC	Mekong River Commission
NEPAD	New Partnership for Africa's Development
NFP	National Forest Programme

NGO	Non-Governmental Organisation
NTFP	Non Timber Forest Products
ODA	Official Development Assistance
PA	Protected Area
PES	Payment for Environmental Services
PFM	Participatory Forest Management
PRS	Poverty Reduction Strategy
ReNED	Research Network for Environment and Development
SADC	Southern African Development Community
SAFE	Sustainable Agriculture for Environment
SafMA	Southern African Millennium Ecosystem Assessment
SWAp	Sector Wide Approach
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USD	United States Dollar
VNRC	Village Natural Resource Committees
WB	World Bank
WHO	World Health Organisation
WWF	World Wide Fund for Nature

Introduction

The overall objective of this second ReNED conference was to contribute to the achievement of the following ReNED objectives:

- Increased interaction between researchers and practitioners and ensuring an improved level of information for the Danish environmental assistance in terms of knowledge and the latest research as well as more efficient coordination of information exchange
- Strengthening of the contact to relevant international and regional research institutions, the private sector and NGOs

Thematically, the aim of the conference was to contribute to the understanding of the importance of biodiversity in terms of maintaining or developing ecosystems services such as fisheries, forest products, genetic resources for agriculture, pollination of crops and fruit trees, carbon sequestration in soils, water, human health, and eco-tourism. The conference addressed five key concerns:

1. The importance of biodiversity for maintaining the quality and quantity of ecosystem services
2. The value of biodiversity in relation to ecosystem services. To whom is this value important?
3. Sustainable financing mechanisms and community based management systems. Which types of payments are appropriate in terms of institutional set-ups, the role of local population, etc, and what are the needs for support?
4. Biodiversity and ecosystem service monitoring. How can appropriate monitoring systems be designed in order to ensure sustainability of the system and the desired impact on the biodiversity and people?
5. How do we develop and maintain institutional capacity and good governance in the South regarding these topics?

The conference aimed at providing recommendations for research and development assistance within these different concerns.

Background

All human beings rely upon the services of ecosystems and manipulate them either directly (farming, mining, fishing, hunting, water, extraction of forest products, deposition of waste and sewage) or indirectly (emission of green house gases) in order to sustain life. The rural poor in the Third World, in particular, rely upon these services for food, clothing, medicine, construction, fuel wood, water and as a source of income.

Some of these services are considered free of charge, such as free access to beaches and resources in marine areas, access to terrestrial habitats and extraction of non-timber forest products in developing countries. By the implementation of the Convention on Biological Diversity (www.cbd.org) some guidelines for the transfer of genetic resources and intellectual property rights were agreed upon by most countries. A utilitarian perspective was applied after Rio-92, and this has been further developed into the concept of “Ecosystem Services”.

This concept arose because a major part of the World biodiversity is found in the ecosystems of the tropics where many people rely on the services provided by natural habitats. Tropical rain forests and coral reefs are the most diverse ecosystems of the earth and about half of the global human population lives in or near by these ecosystems and population growth rates are high. Despite the rich ecosystems, poverty – particularly in rural areas – is predominant in many African, South and Southeast Asian, and Latin American countries. The North, on the contrary, is rich regarding GDP and relatively poor in biodiversity, but utilizes many of the services provided by the ecosystems of the South.

The living organisms, their genetic variation and the ecological complexes of which they are part constitute the biological diversity or biodiversity, and they are integral parts of the ecosystems and fundamental for the functioning of these. Biodiversity is vital for sustainable development and the major reasons for that are as follows, see also Barrow 2005¹:

1. The environment is changing and challenges agricultural crops, livestock, and pharmaceutical products. New pests and diseases evolve and create new demands for pest control and medicine. Material from organisms is constantly needed to meet these demands
2. Genetic material is needed in the development of new crops, drugs & antibiotics, new races of fish, crustaceans and molluscs for aquaculture, bacteria and yeasts for fermentation or biological treatment of waste
3. Biodiversity has a philosophical and ethical value, it may inspire new ideas and scientific advances, and humans have a moral/ethic obligation to protect it
4. Sustainable development dictates that we should pass on to the coming generations at least the same amount of biodiversity as we enjoy at present
5. Habitats/environments, whose biodiversity have been degraded, may be less resilient and recover slowly. Degradation may also result in changes in local climates (e.g. rainfall pattern) and erosion and its side effects (landslides, unclear water, silt, etc.)
6. In the developing world, biodiversity is important for ensuring resources for local communities. Communities near these biodiversity areas benefit from the services provided by the area, but some services also benefit people further away
7. Intact ecosystem services may also prevent conflicts related to scarcity of resources

These issues guided the formulation of the conference objectives and five key concerns listed above.

Strategies for development assistance, research and capacity building

An important objective of the conference was to provide recommendations on research needs and future strategies for development assistance and to exchange experiences among researchers and promote coordination of research efforts. The concepts of biodiversity conservation and ecosystem management have been part of the Danish environment and development assistance for more than a decade and there are important research groupings in Denmark working in this field. The following issues for discussion related to the five key concerns mentioned above were central to the conference:

¹ Barrow, C. J. 2005. Environmental Management and Development. Routledge Perspectives on Development, Oxford 276 pages.

1. The volume of research on biodiversity is fairly large, but interdisciplinary research exploring the complex linkages between biodiversity and ecosystem services is less common. Moreover, recent scientific hypotheses regarding global change combined with increased human pressure on natural resources justify new research initiatives regarding sustainable use and protection of natural resources. Such basic research is of particular importance to development assistance in order to avoid that strategies are based on the wrong assumptions.

2. Valuation of biodiversity is a highly contentious issue, but it is nonetheless important in order to provide development planners and politicians with tools for assessing the economic importance of different habitats, species, etc. Critical research on economic valuation with its advantages and shortcomings is still needed, particularly in the developing country context

3. Achieving sustainable financing mechanisms in natural resource management is a key concern for development assistance and more research is needed to understand which systems work and analyze the causes of successes and failures. An example is the decentralisation processes in the forest sector of which one aspect is to ensure that there are sufficient incentives for involved parties to ensure long-term sustainability. Danish development assistance has supported decentralisation and community based natural resource management in many countries and the issue of ecosystem services and fair payments is high on the development agenda.

4. As natural resources are crucial to both rural and urban livelihoods across the developing world and contribute substantially to national economies, monitoring of natural resources is becoming increasingly important. At the international level, several macro-policy initiatives such as the United Nations' Millennium Development Goals, the 2002 Johannesburg World Summit on Sustainable Development, and related commitments by European Union member states have committed governments to achieving quantitative targets in reducing poverty and using natural resources in a sustainable manner. Yet, important though these high-level goals are, policy-makers simply will not know whether the goals are being met without robust and representative systems for monitoring the changing state of natural resources.

The past two decades have seen a progressive shift towards encouraging local communities formally and more effectively to manage their own lands in ways that are compatible with agreed development goals. There is, thus, a need to study the potential of locally-based monitoring to complement conventional monitoring and translate this into tangible results on the ground and ensuring the sustainability of ecosystem services.

5. In many countries there is a need to clarify the complexities involved in protected area management. Objectives, functions, and management of protected areas (PA) in relationship to biodiversity protection inside and outside the PAs and the national and international conventions are not always well defined. This is aggravated by the need for capacity development, particularly in low income countries, where the management structure is weak and staff in both the public and private sectors lacks training and up-to-date knowledge on environmental issues. Recent reliable data on plant and animal resources are frequently not available at the national and local level, and staff and students at the universities need upgrading of scientific skills in order to make the institutions viable and in order to nest knowledge in the developing community. The investments made in strategic environmental research and capacity building during the 1990s are in urgent need

of a follow-up in particular in regions of high biodiversity and in those endangered by environmental degradation.

6. Finally, a particular concern at the conference was the interlinkages between agriculture and biodiversity as farmlands are reservoirs of high biodiversity and the call for farming systems to become an essential part of any biodiversity conservation strategy. This need is underlined in Article 6(b) of the CBD calling for integration of biodiversity in relevant sectoral plans, in the Millennium Ecosystem Assessment, which asks for "integrated responses", and in the GEF Strategic Priority no. 2 calling for the mainstreaming of biodiversity in production landscapes.

Presentations session 1

The abstracts of the speakers are presented (if available) followed by a summary of discussions compiled by the ReNED Secretariat. The slides of the presentations are available in pdf-format with links from the conference programme on the ReNED website: www.rened.dk.

Welcome

Welcome address by Associate Professor Ivan Nielsen² outlining the objectives, background and key concerns of the conference (see sections above). He also thanked the members of the Scientific Committee and the ReNED secretariat for their efforts in organising the conference.

Danida strategies and approaches to biodiversity conservation and ecosystem management

Presented by Henning Nøhr³

Introduction

Danida is a development assistance organisation – an international aid donor. The main objective of Danida is to alleviate poverty as a prerequisite for sustainable development in a world with more than one billion people living in deep poverty.

This naturally brings human beings in the focus of Danida's activities, but we also realise that no sustainable economic and social development for poor people can be achieved without taking environmental concerns into consideration.

This approach is supported by the increasing understanding of the relationship between environmental management and the livelihood, vulnerability and health of poor people⁴ Poor people depend on consumption of wild foods, medicines and fuel, wild plants in farming systems, and biodiversity in crop pollination and pest control. All of which are services depending on biodiversity and well-functioning ecosystems.

On this background it is fully justified that environment in broad terms is one of the biggest thematic area within Danish development assistance with 2.7 billion DKK per year being allocated for environment and environment related assistance⁵.

Major sources of support for biodiversity in Danida include:

- “green” components in several of the 18 countries targeted by Danida's bilateral environmental assistance
- multilateral support, e.g. for the Global Environmental Facility (GEF)
- support for international organisation with a mandate for biodiversity conservation, e.g. International Union for Conservation of Nature and Natural Resources (IUCN)

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⁴ Linking Poverty Reduction and Environmental Management. Dfid, EC, UNDP & WB, July 2002.

⁵ Security, Growth – Development. Priorities of the Danish Government for Danish Development Assistance 2005-2009. Danida, Danish Ministry of Foreign Affairs, August 2004.

- various support to biodiversity research, e.g. support for the Consultative Group on Agricultural Research (CGIAR) and the bilateral programme for Enhancement of Research Capacity in Developing Countries (ENRECA)
- several projects under the framework of Danida's multilateral assistance relating to global environmental problems and the implementation of multilateral environmental agreements.

What is the strategic approach in Danida towards biodiversity?

In the Environmental Strategy for Danida⁶ (2004), which will guide Danida's environmental assistance the next five years, there is a focus on management of biological diversity as a crosscutting issue in natural resource management.

Our international obligation for biodiversity conservation is linked to the Convention on Biological Diversity, but also the fact that management and protection of biological diversity is interlinked with the efforts to achieve several of the Millennium Development Goals, not at least no. 7 on sustainable development. Also the Plan of Action from the Johannesburg summit 2002 includes a target concerning substantial reductions in the loss of biological diversity before 2010. For these reasons, and the significant negative trend in global biodiversity resources as recently indicated by the Millennium Ecosystem Assessment⁷, biodiversity will continue to be an important element in the Danish environmental assistance.

Focus of the strategy will be on an ecosystem approach, preventing over exploitation leading on one hand to loss of biological diversity and on the other hand loss of productivity through e.g. soil erosion, destruction of water resources and desertification.

In some cases protection or controlled use of areas of exceptional biological interest such as nature reserves can be targeted, but always exploring possibilities of involving local communities in joint management and - if any - their sustainable utilization of biodiversity resources. Support may include development of management plans that balance the various interests of user groups with particular attention given to indigenous peoples' knowledge and experiences in use of natural resources. Assistance must have a long term perspective with respect to managing biodiversity, e.g. to sustain and protect endangered plant communities so as to maintain important genetic resources for future generations. In this long term perspective the assistance must address ways to finance the recurrent management efforts (so called "sustainable financing") and create income and jobs for people in the affected areas.

It is important not just to target biodiversity management in a few exclusive areas (hot-spots) but also to manage biodiversity resources in all major ecosystems as such. As an example, forests contain significant natural resources that are essential for the survival of many local communities in developing countries. Over 90% of those who live on less than a dollar a day depend fully or partially on forest production for their livelihoods⁸. At the same time forests are refuges for unique biological diversity. Forests are often threatened by exploitation. Win-win activities that integrate development and protection of natural resources and biodiversity may include:

- promotion of legal, sustainable forestry

⁶ Environmental Strategy. Danida, Danish Ministry of Foreign Affairs, August 2004

⁷ Millennium Ecosystem Assessment (2005)

⁸ Research and the Relationship between Ecosystem Services and Biodiversity – A Review. Cecil. C Konijnendijk, 2005.

- sustainable production based on natural forest resources
- enforcement of forest legislation
- strengthening of community-based management (joint management)
- development of tracing and certification systems that can promote trade in legal and sustainable forest products.

Examples of Danish support for joint forest management can be taken from Tanzania, Thailand and Zambia.

Another example of an ecosystem service depending on rich biodiversity is the natural regulation of pests in crops. Maintaining these natural regulatory systems is in many cases a good investment saving substantial economic costs for pesticides and reducing risks for human health and the external environment. As such integrated pest management (IPM) programmes is an example of an intervention in Danish agriculture support that relates directly to management of biodiversity resources.

What will we do in the future?

Under the strategic framework of the Danida Environmental Strategy most of the existing support programme involving biodiversity issues will be continued. It is though anticipated that certain aspects within biodiversity management will be given increased attention:

- The valuation of services from biodiversity and ecosystems (payment for ecosystem and biodiversity services). More practical experiences needed on setting up PES programmes in various ecosystems, and more research on valuation of ecosystem services
- Better integration of biodiversity management and conservation into the activities and priorities of the national Poverty Reduction Strategies (PRSs)

More experiences on the inter linkage between the livelihood, vulnerability and health of poor people and biodiversity, e.g. with respect to coping strategies, using natural medicine, food security, alternative income generating activities etc.

Nature supporting people: the southern African millennium ecosystem assessment

Presented by Belinda Reyers⁹

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Abstract

Ecosystems provide people with a variety of benefits, commonly referred to as ecosystems services, which range from food and water through services like the regulation of climates and maintenance

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of soil fertility, to less tangible benefits such as spiritual well-being. Policies, decisions and actions at all scales will affect the provision of these services and decision makers will often have to face challenging decisions about trade-offs between these services and other aspects of human welfare; decisions often made without access to the best available information.

The Millennium Ecosystem Assessment (MA) was a 4 year (2001-2005) international effort which aimed to evaluate the implications of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being. The assessment focused on the linkages between ecosystems and human well-being and, in particular, on ecosystem services. This multidisciplinary assessment was based on synthesising and communicating existing knowledge. The MA was made up of 3 global components: 1) Evaluating the current condition and trend of ecosystem services; 2) Exploring future scenarios; and 3) Investigating response options with respect to the provision and management of ecosystem services.

A fourth component of the MA was a sub-global focus involving approximately 30 sub-global assessments scattered across the globe ranging from assessments of a single lake to multinational assessments of tropical forests. These sub-global assessments were based on the conceptual framework of the MA and were not intended to be representative of ecosystems, but rather to meet the needs of decision-makers at the scales at which they were conducted.

The Southern African Millennium Ecosystem Assessment (SAfMA), a sub-global component of the Millennium Ecosystem Assessment (MA), aimed to provide decision makers with information on the consequences of ecosystem change for human well-being in the region. Human well-being incorporates freedom and choice, basic materials and income, health and nutrition, good social relations, and environmental security, while ecosystem services are the benefits that people obtain from ecosystems and can be grouped into provisioning, regulating, cultural and supporting services. A unique feature of SAfMA is its multi-scale structure with 5 local community-scale assessments nested in 2 basin-scale assessments within a regional assessment in Africa south of the equator. The target audience of SAfMA was broad and included key decision makers at all scales to ensure the relevance of results to management and policy development. User group representatives formed User Advisory Groups for all studies, providing guidance on information needs and linkages to decision-making processes.

This presentation aims to provide an integrated view of the 5 different studies that make up SAfMA, dealing with major threads that ran across all studies and scales, as well as summarising the main methods of assessment of ecosystem services and key findings. An experimental approach was adopted for this first ever multi-scale assessment in Southern Africa allowing each study to adopt practical methods while keep multi-scale comparability in mind. SAfMA assessed several ecosystem services, including the core provisioning services of food and water assessed at all scales. Biodiversity was also assessed at all scales as a necessary condition for the delivery of many ecosystem services, but not as a service as such. Fuelwood and cultural services were assessed by the majority of SAfMA studies.

Data collection and collation ranged from participatory approaches at local scales to published studies, modelling approaches, and national and international databases at the basin and regional scale. Methods of assessment included supply-demand analysis of provisioning services, as well as innovative ways of measuring biodiversity condition including models of degradation, measures of

conservation status of ecosystems, an index of biodiversity intactness and conservation value assessments.

Key findings highlight that access to ecosystem services in the region, determined by factors such as poverty and land entitlement, is often more limiting than the physical shortage of the service. SAFMA identified critical food shortages in the north, especially in terms of proteins, despite the agro-potential of the region to meet all food requirements. The SAFMA study region is one of the most food insecure parts of the world and without intervention the alarming level of under-nutrition will increase by 2020. Results also indicate a growing water shortage in the south driven by seasonal “bottlenecks” and highlight the lack of access to safe water as a leading cause of infant mortality in the region. Wood and charcoal will remain essential energy sources in the region and results indicate local scale shortages in places that can be predicted at regional scales.

Biodiversity is unusually high in the region, and with certain notable exceptions, appears to be in a better condition than expected, with the nature-based tourism industry booming. Biodiversity also forms an essential supply of food and traditional medicines in the region. The expansion of degraded lands into the three-quarters of the region’s area, which is still under natural vegetation, but is not formally protected, is the largest immediate threat to biodiversity. While in the longer term climate change has the potential to endanger thousands of species in the region, and have serious impacts on people and the economy.

Cultural services, which include the cultural, spiritual, aesthetic and recreational use of ecosystems, are valued by all people in the region but in different ways. The use of these services ultimately reduces the vulnerability of biodiversity and people in a region. Nature-based tourism is rapidly overtaking traditional harvest based sectors, and is infrastructure rather than demand limited.

Trade-offs between ecosystem services, biodiversity and human well-being are inherent parts of ecosystems. SAFMA highlighted that the same places may be important for the generation of different ecosystem services. Where overlaps occur, it does not necessarily imply that conflict does or will take place, but the management of such areas particularly requires an integrated, multiple-use approach in which different stakeholders are represented. There is frequently a trade-off between biodiversity conservation and the need to earn a livelihood from the land. A marked spatial co-occurrence of problems with ecosystem services and social and economic decline was found in the regional scale assessment.

Results of the assessment illustrate that at least half of the Millennium Development Goals will not be met in Southern Africa unless specific attention is paid to ecosystem services. Based on the assessment and scenario planning exercises SAFMA evaluated responses, which are the ways people adapt to ecosystem change or change ecosystems to suit their needs, and suggested that responses tend to be more effective if they are integrated, match the scale of underlying ecosystem processes, deal with trade offs explicitly and acknowledge uncertainty.

The development of techniques and processes to help decision-makers understand trade-offs and make informed choices is increasingly important in the management of coupled human-ecological systems. SAFMA aims to contribute to this process by highlighting the issues of ecosystem services, human well-being and their linkages which require urgent and concerted attention.

Discussion session 1

Belinda Reyers (BR) was asked whether gaps of research or documentation were identified and whether new issues for the future agenda emerged. BR argued that there was little documentation on cultural and socioeconomic aspects and, hence, SAfMA conducted primary empirical data collection in some of the study area. When asked whether there was feedback to stakeholders BR said that some results were channelled back to the communities through community theatres while User Advisory Groups were also used to ensure transfer of information to other stakeholders.

On the question of possible correlations between biodiversity and tenure, BR responded that it was not an explicit objective of the study to investigate this. Studies show mixed results on this relationship in South Africa.

The conclusion by BR that biodiversity is not always at risk raised a number of questions, including the methods used for the assessment. BR responded that the proportion of different populations of species still remaining was assessed. Areas and taxa of concern were identified, but overall biodiversity at the regional scale is doing better than expected. The issue however causes much debate as conservation biologists do not believe that the picture is so rosy and there may be several gaps related to land degradation, which have not been included in the assessment due to lack of data.

As to whether the assessment has played a role in regional coordination and good governance, BR mentioned that the aim of the assessment was to provide recommendations and policy guidelines. Twenty countries were assessed at a regional scale by SAfMA but only a few of these countries were actually involved as institutions in the assessment. However regional organisations like SADC and NEPAD were consulted to ensure broader coverage. The subglobal assessments were selected from proposals and were not nominated in a top down fashion in the MA,

To the question on whether the MA will make a difference for saving biodiversity, Henning Nørh (HN) stated that concrete contracts need to be established. Payments for environmental services (PES) are an important step in that direction, but more research is needed to develop good systems. BR stated that although economic valuation is very important and that nature based tourism is a potential market in Southern Africa, many of the services assessed do not have markets and may not be appropriately valued using economic measures.

Biodiversity is often perceived as a precondition for ecosystem services and although SAfMA could demonstrate this link for some services it struggled to prove this assumption for all. The final answer is still missing and specific correlations are lacking. Commercial ecosystems are perceived as more important than natural ecosystems, as natural systems do not comply with the needs such as food security.

Presentations session 2

Linking bioprospecting with sustainable development and conservation: The Panama case

Presented by Thomas Kursar^{15,16}

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Abstract

Given the concentration of human population growth and biodiversity in the tropics, severe poverty as well as extinctions also will be concentrated in the tropics. Because of the magnitude of poverty and of biodiversity threats, the limited international resources for economic aid and conservation initiatives can, at best, only mitigate the severe difficulties that confront the world. Therefore developing nations must have the capacity to resolve their problems. Since many developing nations are rich in biodiversity, an attractive avenue of economic development would take advantage of this unique resource. Bioprospecting, or drug discovery, is one approach that could provide sustainable benefits from biodiversity.

Approximately 35% of prescription drugs come from nature, yet, despite the touted promise of bioprospecting, tropical countries rich in biodiversity have received few benefits. Typically, raw samples are shipped to developed countries for further research. In actuality the chances of a raw sample making it to the market and providing royalties are infinitesimally small. Developing nations will only realize economic and conservation benefits from bioprospecting once they receive benefits that are considerably more attractive than the promise of royalties.

In fact, large sums, provided by pharmaceutical companies, first-world governments and international NGO's, are spent on the drug discovery process. Much of this research is conducted at universities and small biotech firms in the US and Europe. We suggest that such research could and should be conducted in developing nations, providing immediate and lasting benefits, even if a drug never makes it to market.

To motivate both conservation and sustainable economic development in Panama, we initiated a drug discovery effort that emphasizes local benefit. The project, termed International Cooperative Biodiversity Groups (ICBG), is funded by the National Institutes of Health, the US National Science Foundation and the US Department of Agriculture. As much of the drug discovery process as possible is conducted in Panamanian laboratories, providing jobs dependent on intact biodiversity, enhancing local research and educational capabilities and training students by providing hands-on research experience. In short, research, plus the many spin-offs from research, represent the benefit of the ICBG to Panama. The changes that will have the greatest impact on a country's ability to resolve its own problems will be the extent to which university training and

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¹⁹ Scripps Institute of Oceanography, La Jolla, California, USA

research become competitive internationally. The ICBG makes a major contribution towards meeting such a goal.

Considerable publicity in Panama's media about the project has enhanced the awareness of conservation and development issues among urban dwellers, including government, educators, and business. This provides an additional benefit insofar as the urban sector of the populace, while interested in development, often is inadequately informed and motivated regarding conservation.

During only 7 years, the Panama group has published a substantial number of research reports on active, novel compounds from plants, corals and sponges and has made discoveries leading to two patents. Additionally fungi and cyanobacteria are under study as sources of active compounds. Project members also have made direct efforts to conserve, protect and manage Coiba National Park, a newly established park in Panama protecting spectacular marine and terrestrial habitats. In summary, the Panama bioprospecting project uses and investigates biodiversity in a manner that provides immediate benefits to the host country, catalyzes the development of additional extensive research and training capacity in the host country and also directly motivates biodiversity conservation.

The relationship between biodiversity and population centers in developing countries

Presented by Jon Fjeldsaa²⁰

Abstract

While the direct values of biodiversity are widely known, less attention has been given to the indirect values, which are hard to define and value. However, the question of how species richness enhances productivity, robustness and resilience of ecosystems has now become a hot research topic. The causal relationships are complex and poorly understood, and studies are still lacking on large spatial scales. However, the recent compilation of large amounts of digital data on biodiversity, ecological conditions and population allows us to search for general correlations. Several large-scale studies suggest that population centres are generally in biologically rich areas and in many cases immediately adjacent to unique "hotspots". This means a high pressure on the main centres of biological evolution. Traditional preservation of nature reserves in areas with few people therefore cannot resolve the current biodiversity crisis. Support is needed to sustainable land use in well targeted places, and this may also enhance the livelihood for people in these areas. The paper provides examples of recent research over these aspects.

Ecosystem valuation: linking biodiversity conservation to human welfare

Presented by Subhrendu K. Pattanayak²¹

Abstract

Part of the puzzle surrounding biodiversity loss lies in an incomplete understanding of how humans value the functions and services that flow from biodiversity conservation. This paper takes a closer look at the links between the conservation of biodiversity and the livelihoods of rural people who

²⁰ Natural History Museum, University of Copenhagen, Denmark

²¹ Research Triangle Institute, NC, USA

live on the fringes of the parks and protected areas. This paper revisits many aspects of ecosystem valuation and evaluation of conservation policies – purpose, methodology, and policy design and implementation – and identifies some of the smoke and mirrors surrounding the links between biodiversity conservation, ecosystem services and human welfare. We use a case study of a biodiversity conservation project on the island of Flores in Indonesia to build a concrete empirical example and bring some data to bear on the topic. This project has resulted in spatially patchy watershed protection that allows the researchers to identify and estimate five kinds of impacts of ecosystem protection on the livelihoods of the people in the buffer zone of the park. We provide monetized estimates of impacts on (1) human health, (2) agricultural production, (3) drinking water availability, (4) timber and fuelwood use, and (5) ecotourism. Finally, we offer three conclusions. First, it is always possible to monetize, quantify or at the very least identify ecosystem services. Second, conservation policy makers should consider outcomes of ecological functions that lie outside the traditional conservation paradigm (e.g., disease control). Third, and most critically, it is imperative that multi-disciplinary teams conduct conservation ‘policy experiments’ to identify causal outcomes (including defensible estimates of ecosystem values) to improve the design and evaluation of biodiversity conservation policies.

Research on the relationship between ecosystem services and biodiversity – a review

Presented by Cecil Konijnendijk²²

Review paper commissioned by ReNED for the conference

Abstract

Review of the research state-of-art indicates that there is scientific consensus that ecosystem properties and functioning and therewith also that ecosystem services depend greatly on biodiversity. The available research also shows, however, that relationships are very complex and seldom quantified, thus calling for more theoretical and especially empirical study. More attention should be given to study of real ecosystems and landscapes, as most empirical evidence has been derived from experimental set-ups with limited complexity. Based on improved knowledge of biodiversity-ecosystem service linkages, valuation of biodiversity and ecosystem services should be done not only in ecological, but also in economic terms. Valuation is to become an integral part of policy making and planning at different levels and should consider the interests and roles of different stakeholders. The role of local communities and the rural poor as those providing and being heavily dependent on ecosystem services should be given more attention. Better economic understanding of biodiversity and ecosystem services can be used to develop market and other financial mechanisms that can support biodiversity conservation in the major tasks it has ahead. Various mechanisms have been developed and implemented, but in most cases not yet on larger scales. There is a need for a better, more comprehensive information base for decision making and planning, consisting of valuation in ecological, economic and socio-cultural terms, as well as monitoring of changes in status of biodiversity and environmental services. The suggested changes in biodiversity conservation based on wider recognition of the ecosystem services concept require major adaptation of institutional frameworks, as well as capacity building efforts.

²² woodSCAPE consult, Denmark

Discussion session 2

On the question whether all the species in populated areas are important to humans and whether the increase in species is important to people or to the environment, Jon Fjeldsaa (JF) argued that the causal relationships are difficult to explain and understand. Does biodiversity exist because of people or do people exist because of biodiversity? No statistics stating explicitly what biodiversity means have been developed. People have different needs, and the importance of poverty, internal and external factors have not yet been analyzed. Local, indigenous people are moving around, which makes it very difficult to conclude anything, but infrastructure development has largely been influenced by the presence of Europeans. Language diversity is also correlated with biodiversity. It would be useful to have more historical data on population and settlement.

The perception of local people on the valuation of biodiversity and ecosystem functions was discussed. Subhrendu Pattanayak (SP) questioned whether local people will pay for conservation if no external funds are available. Local understanding differs and there is a need to analyse if information on conservation values will change local behaviour.

Tom Kursar (TK) emphasised that there is a lack of clear visions on bioprospecting in many countries. It seems however easy in Panama, as it is a small country. Scientists want to study their own biodiversity, but they are not always understood by politicians. A vision to delete the disconnect between scientists and politicians is needed.

Presentations session 3a

Discussions are presented in the section on working groups.

Mangroves... the “life-saving belts” of coastal areas in Thailand

Presented by Sanit Aksornkoae²³

Abstract

The mangrove ecosystem is totally different from most other ecosystems. Mangroves are unique and have special, highly complex characteristics. They are transitional ecosystems between land and sea and between freshwater and seawater. In Thailand, these communities are clearly important to human life and economy of the country. The mangroves play a very vital role to stabilize and maintain various adjoining ecosystems, for example, sea grass beds, coral reefs and marine life. Mangroves represent a unique habitat for a diverse variety of marine and terrestrial animals. The amount of organic matter produced by mangroves will support not only the mangrove ecosystem itself but also other related ecosystems. Moreover, mangroves also play an important role in stabilizing shorelines in coastal streams and estuaries by protecting them against tidal bores and soil erosion. Recently, mangroves can save lives and properties from the Tsunami in many Southeast Asian countries.

Mangrove forest areas in Thailand have been destroyed or degraded at an alarming rate. They have been reclaimed for different purposes such as aquaculture, agriculture, resettlement areas, urbanization, salt production, road and transmission lines set-up, mining, construction of ports and harbours, dredging, build-up of various industries and power plants. It was estimated that, between 1961 and 1996, an estimated area of 204,865 ha. of mangrove forests was converted for such purposes. The latest survey in 1996, it was estimated the total existing mangrove forest to be approximately 167,582 ha. Of the estimated total mangrove forest area, about 80 percent can be found along the Andaman Sea coast, which is the western part of the southern Thailand peninsula and the remaining area, 20 percent presents along the coast of the Gulf of Thailand.

On Sunday 26 December 2004, Thailand's six southern provinces along the Andaman Coast, namely Phuket, Phang-nga, Krabi, Ranong, Trang and Satun were devastated by the Tsunami. The Tsunami seriously destroyed or damaged villager's lives and property. Without mangrove forests protecting areas of the coast, the destruction would have been more severe. From observation, many villages and properties in several areas along the coast fronted by dense mangroves were saved from the Tsunami, especially areas in Ranong and Phuket provinces.

The failure to adequately regulate coastal development, and the rush to transform coastal areas into economic zones without carefully considering the environmental aspects especially mangrove forests, were vital factors contributing to more human loss, and damage to property from the Tsunami in December 2004. According to evidence, mangroves could have helped prevent this Tsunami tragedy. It is certainly believed that coastal communities need many more “life-saving belts” that can effectively help filter the energy of strong winds and tidal waves. Mangroves forests, therefore, will be one of the most effective coastal “forts” especially for “Life-Saving Belts” in mitigating the effects from the Tsunami.

²³ Thailand Environment Institute, Nonthaburi, Thailand

Marine protected areas as a mechanism to support coastal ecosystem services and biodiversity in Vietnam

Presented by Nguyen Giang Thu²⁴

Abstract

Vietnam has a long coastline of about 3,260 kilometres, with many islands, lagoons, estuaries, coral reefs, sea grass beds and mangroves. The coastline and its natural resources are vitally important to the national economy, since more than 60% of the population live in coastal regions, while tourism, a rapidly growing economic sector in Vietnam, is also strongly orientated there. However, coastal and inshore marine resources have been heavily impacted by both population pressure and development, with traditional fisheries in particular showing rapid decline. As a result, the livelihoods of coastal people have become increasingly focused on the development of aquaculture and other alternative sources of income, resulting in additional pressure on coastal resources and biodiversity.

The Government of Vietnam recently established a network of 15 Marine Protected Areas (MPA) in Vietnam. This system is based on field surveys and other investigations carried out over the past 10 years. The MPA network is both representative of Vietnam's biogeographical diversity and pioneering in its efforts to promote community participation in coastal and marine protected area management. Initiatives undertaken to support the MPA system include the development of an inter-ministerial Marine Protected Area Steering Committee, chaired by the Ministry of Fisheries; a supporting legal framework and guidelines for MPA establishment; and support to MPA management at the national, provincial and local levels.

Since 2001, Hon Mun MPA in Nha Trang Bay has been piloted as the model Marine Protected Area for the network. Hon Mun is typical of the majority of the MPA sites proposed under the network, being a group of small islands near the mainland (Hon Mun MPA consists of 9 islands and a water area of several thousand hectares); most of the resident population of over 5,000 people rely on fishing and related activities as their primary source of livelihood. Tourism is also an important activity attracting about 400,000 tourists/year.

There are several other priority MPA sites in the network. Cu Lao Cham, Phu Quoc, Con Dao, Con Co, Bach Long Vi are already receiving development assistance, especially through Denmark's Environmental Programme (to be known in future as Danish Cooperation in Environment). Several new MPAs, such as Nui Chua, which is supported by WWF, are being added. There is also a trans-boundary MPA being developed between Phu Quoc Island and Cambodia, with priority being given to the conservation of dugongs and sea turtles). Planning has also started to develop a large coastal MPA in Ca Mau at the southwest tip of Vietnam to promote mangrove conservation together with sustainable fisheries and aquaculture; and possibly a trans-boundary site in the north with China to protect mangroves and migrant birds. Related to the MPA network, Vietnam also has a RAMSAR Site (Xuan Thuy, with coastal wetland and mudflat habitats) a Biosphere Reserve (Can Gio, with rehabilitated mangroves) and a marine World Heritage Site (Ha Long Bay).

Significant progress has been made with marine protection and management activities since the Hon Mun pilot MPA project was initiated in Nha Trang Bay in 2001. A temporary zoning system

²⁴ Ministry of Fisheries, Socialist Republic of Vietnam

has created a number of “no-fishing” areas in which the coral communities and fish populations have stabilized or increased; enforcement activities are operating in conjunction with local communities; and environmentally friendly mooring buoys have been installed in sensitive coral reef areas. A comprehensive “Plan of Management” has also been prepared for longer-term management of the area and a National MPA Training Centre will be built in Nha Trang, so that knowledge and management skills can be disseminated more effectively throughout Vietnam.

An important focus of MPA development in Vietnam has been the creation of a collaborative management approach with local communities. In the Hon Mun pilot MPA, for example, village advisory committees have been established in each village and regular meetings provide the opportunity to discuss approaches to management. In cases where access to fishing grounds has been compromised, initiatives to assist families to generate additional income have included training in aquaculture, handicraft activities and the provision of small investment loans credit to over 60 households.

At Cu Lao Cham MPA, which is supported by a Danida funded project, an MPA Club has been formed to represent all the island stakeholders. The Club Committee is chaired by the Youth Union and educational and income-generating activities are provided to local people through the Club. Special efforts are also given to assist women on Cu Lao Cham, by channelling support through the Women’s Union at district level in Hoi An.

Another key feature of environmental management in Vietnam is that the ecosystem services which protected areas help to support and safeguard now feature tourism, or have significant tourism potential. Many of Vietnam’s MPA sites support both eco-tourism and popular tourism, or what in Vietnam is better termed “tourism based on nature”.

Tourism in and around MPAs can provide much needed economic development and employment, but all forms of nature tourism have an impact, which requires some regulation and monitoring. In this regard, the major challenges for Vietnam are (a) to use the potential from tourism to build sustainable financing mechanisms for MPA management; (b) to assist local communities to participate in and gain livelihood opportunities from tourism; (c) to ensure that other ecosystem services, especially to fisheries and fishers, are not affected negatively by tourist development involving MPAs.

A vital first step towards meeting these challenges is to fully value the ecosystem services and biodiversity which MPAs help to sustain. This is an aspect of environmental research and policy development that Vietnam particularly needs assistance with, especially since many of the benefits from MPAs are indirect, or have low visibility to decision-makers.

Presentations session 3b

Discussions are included in the section on working groups.

Participatory forest management for sustainable community development: lessons learnt in conservation and management of Udzungwa Mountain Forests, Iringa, Tanzania

Presented by John Massao²⁵

Abstract

Tanzania mainland is endowed with natural forests and woodlands distributed throughout the country. Approximately 13 million ha. of these habitats are legally protected and managed as production or protection forest reserves (FRs). Approximate 4% of the protected areas are part of the internationally recognised Eastern Arc and Coastal Forest Biodiversity Hotspot, with about 500,000 ha Eastern Arc Mountain Forests and about 75,000 ha Coastal Forests.

This paper presents the experiences of implementing Participatory Forest Management in montane evergreen forests in the Udzungwa Mountains, Iringa District. The Udzungwa Mountains is a component of the globally important Eastern Arc biodiversity hotspot. The Eastern Arc Mountain Forests stretches from southern Kenya to the Udzungwa Mountains in south central Tanzania. The hotspot is today considered among the five most species rich areas in the world in terms of number of endemic species in relation to area of forest. At least 85 vertebrate species are strictly endemic to these mountains; 17 species of birds, 8 species of mammals, 27 species of reptiles, and 33 species of amphibians. Data for plants are not fully compiled, but at least 1,500 endemic plants are found, 68 of these being tree species, and several hundred of these plants may be threatened. The majority of the Eastern Arc endemic species are closed-forest specialists, with a few confined to more open habitats such as woodland, grassland, marshes and rocky areas. Site prioritisation shows that the Udzungwas, Ulugurus and East Usambaras are most important for endemic vertebrates and plants.

The montane forests in the Udzungwa Mountains provide a wide range of ecosystem services to the local communities, including medicinal plants, honey, vegetables, thatch grasses, construction poles and bush meat for their subsistence. Wood extraction from forest reserves is not allowed and very limited as alternative wood sources are available in adjacent natural woodlands or planted woodlots. The main threat to conservation in the area today is intensive illegal hunting.

In addition to the biodiversity value, the forests are of invaluable importance to Tanzania's water supply. Sustainable forest management therefore secure valuable eco-system services, not only to local communities, but also nationally in terms of biodiversity preservation, electricity production, urban water supply and agricultural production. Water from the Udzungwa Mountains is source of approximately 64% of Tanzania's total electricity production.

Failure to manage the forest estate in a traditional centrally controlled system led to a decentralisation of the forest sector and Participatory Forest Management (PFM) has been developed as a strategy to achieve sustainable forest management while improving the livelihoods of the rural people depending on forest resources.

²⁵ Forest and beekeeping division, Tanzania

The new Tanzanian Forest Policy (URT 1998) and Forest Act (URT 2002) allow devolution of ownership of and management responsibilities to forest adjacent communities. Based on the new legislation and supported by Danida, the Government of Tanzania from 1999 to 2003 conducted a pilot project called MEMA (Sustainable Use of Natural Resources), to develop, test and implement the PFM concept in the Udzungwa Mountains and adjacent woodlands. Joint management agreements have been inaugurated and the forests are today managed jointly by locally elected Village Natural Resource Committees and District Forest Authorities.

The management agreements describe rights and responsibilities related to management and include a list of ecosystem services available to local communities together with resource specific use regulations. The agreements formally hand over the rights to collect, retain and use natural resource revenue generated from local ecosystem services. The generated revenue is spend on compensating committee members and providing village benefits like new school buildings/school desks, water pipe, etc. to the local community.

A community-based biodiversity monitoring system has been developed as a key tool for Village Natural Resource Committees (VNRC) to ensure sustainable use of forest resources. The system is developed to suit the needs and capacities of local communities, and, thus, rather than measuring biodiversity, the monitoring is focused on resource extraction and disturbance. Formally, the system started with 23 villages that were under the support of DANIDA (1999 – 2003). Today the system is being applied in 60 villages under PFM in Iringa apart from contributing significantly in developing the national guidelines for resource monitoring.

The VNRC members of each village spend approximately 300 man-days annually on managing and monitoring the forests. Data collected one year after implementation show a high commitment level and indicate that the monitoring scheme provides committees with the relevant information needed to suggest appropriate management interventions. Information from monthly monitoring forms submitted to the district natural resources office by the communities, are being incorporated into the village management plans currently under final review. Compensation allowances for attending VNRC activities in woodland and montane forest areas range from USD 0-1.75 per day, the average being below USD 1.00.

In the montane forest areas, national and global interest to preserve catchment values (i.e. electricity production, agriculture, fishing and livelihoods) and biodiversity means that the government has banned wood resource extraction. Because of this, opportunities to provide economic incentives for montane forest managers through direct utilisation of the resource are limited and it remains to be seen whether other non-economic incentives can sustain long-term commitment in these biodiversity rich areas.

Another problem for successful implementation of PFM is that it appears that most technical field staff spend most of their time in towns lobbying for activities that provide per diems or in other ways increase their income rather than being in the villages exercising the necessary support.

A central issue in the PFM debate, is that communities are given responsibility of government (stewardship of a national resource) in exchange for ecosystem services – but in reality there are very few benefits in montane forests to share with those communities in exchange for the costs incurred and the support from the authorities is insufficient to ensure sustainability of the management and, thus, also of the resource use.

As a consequence PFM can probably not work in the longer term unless additional benefits to swing the costs/benefits ratio can be identified and made to work. Payments for ecosystem services (in this instance water and biodiversity) would represent an opportunity to increase the benefits and moral support for effective management. At present, however, there is no political will or international pressure to implement fair payments for managing nationally (and globally) important ecosystem services. The future of the unique Eastern Arc forests is therefore uncertain.

Biodiversity in the farmscape: farmland action planning for biodiversity in Thailand

Presented by Kirsten Ewers²⁶

Co-authors: Kevin Kamp²⁷ and Hein Bijlmakers²⁸

Abstract

Global biodiversity conservation efforts are focused on natural ecosystems and protected areas and less on biodiversity conservation within agriculture. Consequently, less attention has been given to agricultural considerations in projects supporting biodiversity. And conversely, little attention has been given to biodiversity in the development agencies' agricultural development projects.

Agriculture and biodiversity are inter-linked. The agricultural lands are intertwined with and physically linked to river systems, wetlands, forests and grasslands, and the importance of biodiversity within the “farmscape” was recognized by the Parties to the CBD in 2002, which recommended conservation and sustainable use of (soil) biodiversity and agricultural biodiversity in general. Besides being a reservoir of *species diversity* agricultural lands also hold a *genetic diversity* within species and populations that is crucial. Worms, insects and fungi decompose organic matter to ensure the recycling of nutrients and the breakdown of toxic substances. Bees, butterflies, birds and bats are important pollinators for a significant number crops and natural plant species.

For the farm families biodiversity provides food, income, materials, medicine, crop protection, cultural/social significance and a qualitative living environment. Therefore, farmland biodiversity provides a powerful opportunity for setting biodiversity conservation goals by the farm communities that are inextricably linked with “their” own biodiversity. The case presented here comprise of the Danida-supported *Sustainable Agriculture for Environment* (SAFE) project and the *Integrated Pest Management* (IPM) project in Thailand working with the Department of Agriculture and the Department of Agricultural Extension.

The SAFE project promotes several elements of sustainable agriculture including community-based biodiversity/habitat planning. Practical work on farmland biodiversity in SAFE is divided into promoting farmers' own research skills and community-based habitat action planning (HAP) respectively. Promoting farmers' research skills helps these ask the right questions and observe and record changes. It is supplemented by

²⁶ Chief Consultant, Ramboll, project manager and short term advisor

²⁷ Senior Technical Advisor, Sustainable Agriculture for Environment Project, Danida, Thailand

²⁸ Senior Technical Advisor, Integrated Pest Management Project, Danida, Thailand

research carried out by government research bodies. Using established farmer groups as the starting point, HAP takes place through promoting awareness raising, knowledge and understanding of what biodiversity in agriculture is and the diverse management practices possible in the given agro-ecological and socio-economic context.

The IPM project has as one of its objectives to improve the environment, including its biodiversity, as well as the safety of farmers and consumers from hazardous uses of agro-chemicals. IPM is a process of decision-making and farming that can be improved with greater ecological knowledge, and observation skills. Farmers monitor the field situation once a week, soil, water, plants, pests, natural enemies and so on. They learn to study life cycles of insects and their feeding behaviour and linkages to the ecosystem.

Official Development Assistance (ODA) and agriculture

The proportion of ODA directed towards agriculture and rural development has fallen by almost two thirds between 1988 and 1998. The European Commission/EU spent more than six times as much supporting EU agriculture and fisheries as on development assistance. This, along with tariff and other non-tariff barriers, clearly limits opportunity in agriculture in Third World countries. Danida does not have a strategy or policy on agriculture any longer, which contrasts strongly with the situation in 1989 after Brundtland, where 2 strategies for environmental concerns in agriculture of the dry lands and wet tropics respectively were published. Their aims are still valid today.

Lessons learnt and recommendations to Danida and ODA agencies on pro-poor ways to reverse negative environmental trends and address biodiversity in agriculture based on the contention that well managed agriculture can conserve soil and water resources, preserve trees and biodiversity and contribute to the locking up of carbon. Danida and ODA agencies should:

- Support institutional research as well as farmers' own research capability on plant, fish and livestock varieties in the farming system of importance to the poor, including less well-known varieties for their integration into the local ecosystem
- Strengthen developing country capacity for research and development on the potential of biodiversity to support livelihoods, particularly through participatory research
- Fund basic research in biodiversity hotspots on interactions between agricultural systems and wildlife habitat and species, particularly in landscape ecology, agricultural ecology, and wildlife behaviour.
- Develop programs to educate farmers, agricultural researchers and agriculture policymakers in ecosystem management and programs to educate wildlife biologists, ecologists and conservation policymakers in agricultural resources and farming systems management
- A special recommendation is institutionalising a focus on the biodiversity in peri-urban agricultural areas where biodiversity should enter at the level of urban planning with an eye out to preserve biodiversity in this landscape (remnants wetlands, ditches)

Presentations session 3c

Discussions are included in the section on working groups.

Community based natural resource management (CBNRM). Is it the solution or the problem to biodiversity management in Africa?

Presented by John Balarin²⁹

Abstract

Throughout centuries, African societies have depended on the continents rich biodiversity (i.e. fish, wildlife and forest products) for their survival, food security, fuel, medicines and livelihoods. At least 90% of household energy is from forest fuels. Wildlife, once the only protein source, unlike fisheries, seemed not to be managed to maximize production. In the first half of the 20th century, protected areas were set-up as “biodiversity banks”, often superimposed, and excluding existing cultures. This leads to a trail of discontent that has stigmatized biodiversity conservation at grassroot level. Poverty, food insecurity and open access, has led to overexploitation of resources, threatening biodiversity. Advocated as the solution is to empower community management.

Natural resources in Africa are “public goods”, are undervalued, in the informal sector, and are not part of the tax-based economy. The state does not derive much in the way of licensing and tax revenue and, are consequently handicapped in providing services, research, extension or enforcement. Often, under the social sympathies, and political pressures associated with poverty, the state is reluctant to act on the law. It is difficult to make “users pay”, if they happen to be poor! The “state of no management” that prevails, can be equated with, 100% management by the community! Such sympathies lead to an oversight in the economic valuation of the real market chain. The producers, the rural poor, are often “hired hands”, receiving the lowest fraction of the real market. Traders and middlemen control the value-added chain, but contribute little to a tax economy, to resource management, and look only at economic returns.

A quarter of the forest estates in developing countries are under community control. Globally, 40% of fish production is farm-based. In Denmark, 50% of the wildlife estate is under user group management. In all cases, the state prevails as co-management partners, in control of enforcement. The lesson learnt is that state involvement is essential to support community management!

In Africa, from the 1980s, efforts were made to introduce Community Based Management of Natural Resources (CBNRM), but, the track record has been poor. Perhaps the social dimension that “community” means the poorest of the poor has been the oversight. Equally to blame is the state has not engaged as a partner. To succeed, biodiversity conservation must engage the full economic community, and all its multi-faceted dimensions, in co-partnership with the state. Poverty reduction and how the user group and trader will value biodiversity, hinges on a balance between ecology, socio-economics and technology, and the degree of state involvement in management. Often the missing elements that define co-management are to do with the lack of an appropriate legal framework, to permit legal rights and trade, and the institutions that are needed to enforce it. Sometimes, the technical-know how is missing. Knowledge is limited! Users and traders, are unaware of alternative livelihoods, or associated husbandry opportunities! For CBNRM to work, we

²⁹ Danish Hunters Association, SE Africa CBNRM of Wildlife Program, Pvt. Bag 396, Lilongwe, Malawi

find that the legal and technical tools are not yet with us. What is clear is that state and community must work together. This can vary in the degree of collaboration, but for biodiversity conservation, state and community must work hand in hand as co-partners.

Grasshopper and locust control in Sahel: biodiversity and ecological services

Presented by Niels Elmegaard³⁰

Abstract

Grasshoppers and locusts are important elements of the insect fauna in large parts of the world particularly in grasslands. Due to conflicts with human interests there are extensive control programmes in North and South America, Asia, Africa, and Australia. In Sahel long distance migrating locusts and regionally migrating or local grasshopper populations threaten the harvest of millet and other crops. The shortage of food in the region accentuates the wish to control pests. The ability of agro-ecosystem to resist pest outbreak is in general of great importance as an ecological service. The resistance of the system towards pest outbreaks reduces the need for insecticide use, which pose a threat to biodiversity and actually may affect the mechanisms controlling pest populations. Pesticide use may also threaten the health of humans and domestic animals and impose an economic cost on farmers or society.

Towards the north in Sahel, the proportion of land covered by fields decreases and the grassland area increases. Preventative locust and grasshopper control has to be carried out in both cultivated and uncultivated land as the pest do not prefer the crop plants as food at all times. The insecticide treatment of uncultivated areas increases the potential impact of pest control on biodiversity in the region.

The main mortality factors affecting grasshopper populations in Sahel are egg predators/parasitoids and birds eating adults and larvae. Birds are at the same time conceived as an important part of the biodiversity. As the grasshoppers are a very dominating element of the grassland fauna they play a key role as food resource of birds in the ecosystem food webs and a significant part of the species are dependent on grasshopper and locust populations. This adds to the complexity of the pest control issue, which in some aspects is a double-edged sword. The locust and grasshopper swarms are not only to be seen as a pest problem but also a natural phenomenon and a part of the ecosystem dynamics.

The ecological dilemma of locust and grasshopper control is the subject for research involving microbiological control agents, insecticide application timing, population models, and GIS based decision support systems. Ways forward to obtain a regional programme for environmentally sound grasshopper control in the Sahel are to be outlined as a result of this research. Future strategies will be based on a better understanding of the economic benefits and the environmental risks associated with different control strategies. Such knowledge makes it possible to base decision on local circumstances like climate, soil type, environmental and conservation concerns.

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Presentations Session 4

Correlations between biological diversity and the provision of water resources in Africa

Presented by Neil Burgess³¹

Abstract

Work undertaken at the University of Copenhagen, University of Bonn and elsewhere has mapped the distribution of biological diversity in Africa. Work being undertaken within the Conservation Science Programme of WWF – USA is mapping the distribution of ‘water sources and sinks’ across the world. This paper will combine the mapping of biodiversity and water source areas to assess if there is a broad correlation between centres of African species endemism, which are mainly located on mountains, and water source areas. Detail will be provided on one of the important areas - the Eastern Arc Mountains in Tanzania. This will show how biodiversity patterns at the fine scale correlate with water generating and water utilizing areas.

Maintaining ecosystem services by conserving coastal biodiversity: some examples from Southeast Asia

Presented by Donald Macintosh³²

Abstract

In situ protection of species is widely regarded as the best method of preserving genetic diversity, while species are best protected by conserving their natural habitats. Coastal habitats are particularly important to biodiversity conservation because the coastal zone is physically very narrow – usually from a few metres to a few kilometres. As the margin between land and sea, this zone supports not only unique intertidal species of fauna and flora, but also many other forms of both marine and terrestrial wildlife.

Coastal habitats and biodiversity support a wide range of important environmental services in Southeast Asia, one of the most coastally dominated, but heavily populated regions of the world. These services include 1) physical protection of the coastline by mangroves and coral reefs; 2) coastal biodiversity that provides a wide array of products used daily by local people; 3) ecological processes and species that support fisheries and aquaculture; and 4) various services valuable to the growing tourism and recreation sectors. In Southeast Asia, however, human population and development pressures have already caused widespread destruction or degradation of many coastal habitats. Biodiversity and ecosystem services have declined accordingly, with severe consequences to the socio-economic well being of millions of people. As a result, habitat rehabilitation and coastal environmental clean-ups have become necessary interventions in several countries.

The Asian tsunami directed world attention on coastal disasters and the need to improve coastal protection as a vital element of any disaster preparedness programme for the coastal zone. Although tsunamis are rare in the tropics, typhoons (hurricanes), tropical storms, monsoon rains and flooding

³¹ UNDP-GEF and WWF-USA

³² Centre for Tropical Ecosystems Research, University of Aarhus

feature prominently and apparently with increasing frequency or severity, as recurrent natural hazards in South and Southeast Asia. Mangrove rehabilitation has proved effective as a coastal protection measure in several Asian countries. The benefits to biodiversity and therefore to other environmental services have also been significant. Examples from Thailand and Vietnam will be used for illustration.

There are numerous examples showing the importance (value) of coastal biodiversity in maintaining ecosystem services that support fisheries and aquaculture. The role that biodiversity plays is demonstrated most clearly at the level of subsistence livelihoods among the millions of people in Southeast Asia who still depend on daily harvesting of products from the intertidal zone for food and income. Using simple hand tools, these people collect species that are most valuable or abundant. Aquatic collectors fall into two main categories (a) generalists and opportunists who switch from species to species according to their availability; (b) those who are more specialized collectors of a particular species or species group. In the case of opportunist collecting, it is vital to protect coastal habitat from overexploitation via “no take” zones. In cases where particular species are targeted, protection of key stages of the life cycle, or food sources, also have to be considered; but in order to be effective, these considerations may also have to be linked closely to habitat conservation.

Coastal aquaculture has also impacted directly on coastal habitats, particularly mangroves, and affected biodiversity by creating or increasing the demand for juveniles or “seed” of aquatic species which previously had little or no value. While traditionally fishers caught only the adult stages of various fish and crustacean species, they now collect the juvenile stages in huge numbers to support coastal aquaculture, thereby exerting pressure on more stages of the species life cycle. In Southeast Asia, groupers, penaeid shrimp, mud crabs and cockles are diverse examples of valuable species heavily in demand as seed for aquaculture.

Increasingly, coastal biodiversity is supporting environmental services used by the tourism sector, especially for what is rather vaguely termed ecotourism. Despite a number of temporary set-backs (economic recession, SARS, the tsunami), tourism is expanding rapidly in Southeast Asia, with much of this sector’s development directed at the coastal zone.

Marine Protected Areas (MPAs) are critically important as a tool for conserving biodiversity and as a management system for achieving a sound basis for sustainable use and development of marine environments and habitats. However the objectives for MPA establishment have frequently been misunderstood, leading to lack of cooperation, and even conflicts, between management agencies. MPAs established for fishery conservation reasons inevitably, even if unintentionally, also contribute to the protection of biodiversity. Conversely, nearly all MPAs established for the primary purpose of protecting biodiversity also benefit certain fishery stocks. They achieve this by supporting critical stages or locations of their life cycles, such as their spawning or nursery areas.

Added to the issues surrounding fisheries and biodiversity is the question of the role and impact of tourism on MPAs? Tourism is potentially of high economic value to MPA stakeholders, while biodiversity is a major attraction for tourists to MPAs. Here the biodiversity-habitat-environmental services relationships become very clear and, moreover, it can be valued accurately. Examples will be given of coral reef and mangrove forest biodiversity supporting dive tourism and boat tours, respectively. Flagship species such as dugongs, marine turtles and sea eagles are particularly

valuable attractions for tourists; several examples of the use of flagship species to promote ecotourism will be provided from marine and coastal protected areas in Southeast Asia.

Ecosystem services classified at the health interface, an interdisciplinary perspective on biodiversity and health

Presented by Jacobien Scherpbier van Holthe³³

Abstract

Human beings are an intrinsic part of nature and they depend on nature's biodiversity for a healthy diet, clean water, shelter, energy and medicines. Ecosystem services such as oxygen and clean water are vital to human life. Ecosystem goods such as food crops, timber and medicinal plants help to maintain good health, boost economic growth and reduce poverty. Human beings manipulate and abuse their surrounding environments to extract ecosystem goods in order to satisfy their continual requirements. Some of the resulting adverse effects are over-consumption, diminishing biodiversity and expanding numbers of endangered species. The situation is further aggravated by increasing over population, perpetuating a worrying rise of lasting environmental change especially since the past 50 years. This accelerated environmental change is a global problem and has evident consequences for public health.

The greatest range and volume of biological diversity is held by developing countries, where poverty is widespread and its population depends specifically on genetic resources for survival. When sustainable ecosystem management is neglected in these countries, environmental degradation can become problematic. Food security is jeopardised, susceptibility to disasters and hazards like flooding, landslides and pollution increases. Pathogenic organisms or vectors can no longer be adequately resisted and human health becomes more vulnerable to illness and disease. Moreover, people in developing countries, and especially so women and children, share the largest part of global disease burden. Increasingly, health services in these countries are experiencing difficulties to cope with rising demand, emerging diseases, increasing drug resistance and the need to find new cures. In order to alleviate this burden of disease and ameliorate livelihoods, to decrease human and environmental vulnerability, and to overcome the vicious circle of ill health, poverty and unsustainable use of natural resources, an integrated approach to biodiversity conservation and public health is imperative.

Scientists, environmentalists and health professionals are increasingly aware of the importance of taking action on the reciprocal linkages between the environment and public health.

- The international community adopted the Millennium Development Goals (MDGs) as a set of targets to orient and assess progress in human development. The MDG's do justice to critical environment and health linkages and are useful for the development of integrated approaches to biodiversity conservation and public health.
- Linkages between biodiversity conservation and human health were recently explored when the World Health Organization (WHO) and the World Conservation Union (IUCN) collaborated in preparation of the 2004 World Conservation Congress in Bangkok and determined possible interdisciplinary action by identifying the following linkages:
 1. Ecosystem management and impact on human health
 2. Water and human health issues

³³ WHO Consultant

3. Biodiversity conservation and issues related to production and consumption patterns

The development of improved health, environment and economic impact assessments which should bring the benefits of collaboration to evidence was recommended.

- The recently published Millennium Ecosystem Assessment (MA) values the role of science in evidence informed decision making, however puts people at the heart of the solution. It stresses the role of ecosystem services on all aspects of human well-being and recognises that the future of biodiversity will ultimately be determined by society.

There is a need for practical, evidence based interventions for mutual reinforcement of sustainable ecosystem management on one hand and public health improvements on the other. These interventions can be targeted at the policy and implementation level.

- At the policy level, reinforcement of the MDGs could bring about the necessary integration. To achieve the Millennium Development Goals it is necessary to strengthen or innovate public policies. Such policy innovation should include a greater emphasis on the cross-cutting character of issues of environment and health, the creation of an enabling setting for more effective intersectoral collaboration and the establishment of a strategic alliance between biodiversity conservation and health sectors. Overseas development aid agencies should be stimulated to continue their focus and funding on the MDG's to stimulate inter-disciplinary debate and research on environmental and health links in interactions with policy makers and scientists.
- At the implementation level, ecosystem services can form a bridge between biodiversity conservation and public health. Community involvement in biodiversity conservation efforts in developing countries can be supported through interest in health related ecosystem services.

In order to facilitate common discourse for the involved disciplines, classifications of ecosystem services and classifications of health services, in which proximate and more distant determinants to mortality are identified, are used and integrated. A stepwise approach is suggested moving from proximal to distal health related ecosystem services, thus establishing the necessary practical entry point for interventions. Development aid agencies should stimulate and fund developing country implementation capacity and research to use ecosystem services for improvement of biodiversity and health links. Moreover they should develop programmes to educate public health policy makers, researchers and staff in biodiversity conservation and ecosystem management and, conversely, to educate conservation policy makers, ecologists and wildlife biologists in public health.

In conclusion:

Human health depends on a biodiverse, healthy ecosystem. Overexploitation of ecosystem services (and -goods) jeopardises biodiversity and public health. In view of the fact that health is a good entry point for change - being of immediate concern to people in developing countries - links between biodiversity conservation and public health need to be reinforced. Associating Primary Health Care and Primary Environmental Care has shown potential and can become one of the practical future strategies for development assistance. In order to bridge communication gaps and to enhance communication across disciplines, it is recommended to establish common idiom for biodiversity conservationists and public health workers, and to classify ecosystem services according to their proximity to health and prioritise first proximal, then intermediate and distal ecosystem services. This will help in the determination of entry points for intervention.

Biodiversity, ecosystems services and genetically modified organisms

Presented by Gábor Lövei³⁴

Abstract

The precise dependency of different ecosystem functions on types and levels of biodiversity is not clearly established and is hotly debated in ecology. However, it is generally accepted that biodiversity is essential for the proper functioning of ecosystems. Several of such functions have direct or indirect benefits for humans, and have been termed “ecosystem services”.

Ecosystem services have traditionally been considered inexhaustible, due to their intensity and scale. With a human population currently at >6 billion and increasing, our impact on global scale reached a point where we can, and do, modify ecosystem services. Ecosystem services cannot be replaced by technology, and their intactness is arguably more crucial in less developed regions of the world that have practically no possibility to replace or substitute them at any effective scale, than in developed regions of the world. Developing regions also have most of the global biodiversity hotspots, often overlapping with population growth hotspots.

Food security and resource use are important concerns for societies in developing countries. Science and technology can have important roles to help achieve societal goals, but any new technology should consider the impact on ecosystem services.

A novel agricultural technology, which can have a role in increasing food security in developing countries, is the field growing of genetically modified (GM) crop plants. Currently, GM plants are grown on an estimated 80 million ha world-wide, mostly in developed countries. The theory and practice of GM plant growing has a wide range of relevant questions that are currently unsettled. In this paper I argue that the environmental impact assessment of GM crops in the developing countries should be done using the theoretical framework of ecosystem services, and impacts on both biodiversity and ecosystem services should be considered.

Discussion session 4

Neil Burgess elaborated on the model used for correlating biodiversity and water provision. It was based on a one degree grid and is as such not perfect. However, Jon Fjeldsaa emphasised that at smaller scales, e.g. in montane areas, correlations may actually be better than the large scale data suggests. The precise explanation of why this correlation exists is not known as the significance of different species and their role for water conservation are not well described – and consequently it is difficult to predict what happens if the species disappear.

A discussion followed on whether eco-tourism can be considered an environmentally acceptable solution to ecosystem management in the long term. While local environmental impacts may be positive, eco-tourism typically targets international markets and the overall ‘ecological footprints’ of global travel may be more environmentally damaging than the benefits achieved locally.

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Finally, the role of GM crops for food security and whether development assistance should encourage their use was discussed briefly. There are still many unknowns in this area and it is ultimately a political decision.

Presentations sessions 5 and 6

Relationships between institutions and regulation, markets and use of biodiversity

Presented by Henrik Egelyng³⁵

Abstract

This paper presents an analysis of some current developments in the globalisation of biodiversity based pest management – an area where the market and the private sector play a role and where regulation is an important factor influencing the direction and “biodiversity content” of agricultural and horticultural production systems – as well as their surrounding landscapes - worldwide. The paper identifies biodiversity based pest management as an area in which private (including Danish) companies has (very) recently initiated collaboration with public and private sector institutions and companies in developing countries. Introducing an analytical distinction between three fundamentally different approaches to pest management – the paper further discusses the general implications for support aiming to build or strengthen institutional and technical capacities in developing countries to provide an enabling environment for production of agricultural commodities of qualities demanded by domestic consumers and by the world market. Finally, the paper raise a question of whether development researchers might need to strengthen their theoretical focus a bit more towards the ecosystem services of “man-made” insects, in a context of agricultural and horticultural production systems, markets and market related institutions to complement the existing body of research on natural biodiversity in “nature” ecosystems.

Linking village-based and project monitoring with national reporting frameworks for biodiversity and community based natural resource management

Presented by Tom Blomley³⁶ and Amina Akida³⁷

Abstract

Forestry development in Tanzania is supported by a range of bilateral and multi-lateral donors, largely through area-based, project support. In the last five years, increasing attention has been given to participatory forest management and also the conservation of critical forest ecosystems such as the Eastern Arc Mountain Forests, recognized as one of the world’s biodiversity hotspots. Monitoring the combined contribution that these initiatives make to increased conservation, improved forest management and sustainable livelihoods has been severely hampered by the prevalence of localized, disjointed, parallel, time-bound and project-driven monitoring systems. The Tanzania government, together with key development partners, is currently supporting moves towards greater harmonization and alignment of development assistance in the forest sector, through a Sector Wide Approach (SWAp), and under the umbrella of the National Forest

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Programme (NFP). As part of this move, emphasis is being placed on developing common monitoring systems through the deliberate linking of project and government monitoring and community based monitoring with national frameworks with a view to assessing the status of key forestry and livelihood indicators at national level. In this paper, we outline some of the challenges of developing integrated, national monitoring systems in the forest sector as well as some of the early lessons learned in Tanzania.

The importance of scientific studies for the understanding and management of environmental services

Presented by Hugo Navarrete³⁸

Abstract

It is common that many decisions taken by entities created to implement policies concerning the use and management of biodiversity, base their decisions on political situations. Some of them are even circumstantial as an answer to a particular moment, instead of taking into account technical information. Scientific studies ideally provide the needed information to support arguments on which reliable decisions can be taken.

At the moment it is vital to reinforce the access and dissemination of the scientific work, to show to the decision makers that this information can be used as a tool to support their environmental and biodiversity use policies, in such a way that these cannot be manipulated to favour a certain political situation.

Capacity development regarding ecosystem services and biodiversity

Presented by Ivan Nielsen³⁹

Abstract

Most developing countries of the World have now adopted the United Nations Agenda 21 and related conventions on biological diversity, climate change and desertification, and they have included the conventions into their national legislations. The effect of that is however rather limited as there has been a drop in environmental topics on political platforms. Capacity development in a

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very broad sense is thus needed. The present review deals firstly with the concepts of capacity and capacity development. It then lists the major needs regarding scientific and technical capacity and it lists a number of constraints and lessons learned from recent capacity development initiatives. Finally suggestions are presented on how to achieve change through higher public awareness, educational efforts, research and the participation of NGOs, indigenous people and the private sector in conservation projects.

Discussion session 5 and 6

The use of the term biodiversity was discussed. In biological terms one single organism is not defined as biodiversity which is a variation between or within organisms. Henrik Egelyng (HE) agreed that there are several definitions on biodiversity, but in this context biodiversity is perceived as a sphere where living organisms can survive. Biodiversity must, according to HE, also be discussed in the context of value and services that individual living organisms provide.

It was argued that effective monitoring is important for policy change and Tom Blomley (TB) and Amina Akida (AA) were asked whether they have tried to operate at the lowest level with both socio-economic and biomass indicators. TB replied that revenue can fairly easily be tracked, but obtaining information on the state of the resource is difficult and costly. Overburdening local communities with requirements for data collection and other information they do not need for themselves must be avoided. It must on the other hand be done at larger scales such as at national level by using tools such as GIS and remote sensing.

TB and AA were moreover asked to outline the major data gaps. From 1992 onwards 2 million ha of community based forest projects have been established and 2000 villages have been involved. However, data on the importance of forests for livelihoods has been difficult to obtain and this is the main problem in this project. It is also difficult to get information from community based monitoring systems on forest recovery as locals do not prioritize whether a butterfly is in the area or not! This is by far the biggest gap in the project.

On capacity building a question concerning the possibility of Danida funding of local scientists was raised. Ivan Nielsen (IN) explained that local researchers learn how to apply for funds as part of the ENRECA training. There is however no funds from Danida to support researchers directly. IN argued that there should be an exit strategy so that the receiver countries can raise funds themselves.

In regard to Hugo Navarrete's (HN) presentation, the success of Quito's water authority in delivering water to the population was acknowledged, but it has had huge environmental consequences as streams dry out, affecting the people depending on the streams. It is important not only to protect areas where water resources occur, but also further downstream. HN agreed on this.

Poster abstracts

1. Crops, trees, and birds: biodiversity change under agricultural intensification in Uganda's farmed landscapes

Presented by Simon Bolwig⁴⁰

Co-authors: David Mushabe⁴¹, David Nkuutu⁴², Derek Pomeroy⁴¹, and Herbert Tushabe⁴³

Introduction

It is widely recognized that agricultural change is an important driver of biodiversity loss in developing countries: the expansion of populations and commodity markets causes the conversion of natural vegetation into farmland and its intensifying use, which in turn renders habitats for wild flora and fauna smaller, more fragmented, and less diverse. For example, an analysis of BirdLife International's World Bird Database indicated that farming is the major current and likely future threat to globally Threatened and Near-Threatened bird species, especially in developing countries where 1726 out of all 1923 birds in these threat categories are found. Farming is at the same time the major source of food and income for a growing number of poor households in developing countries. This suggests an acute and mounting conflict in agricultural landscapes between the conservation of wild biodiversity and the provision of ecosystem services that directly benefit the poor – food, fuel, and fibre.

Global patterns such as the above mask significant variations among different regions and species with respect to the determinants and rate of biodiversity loss, which are important for the design of policies that minimize the trade-offs between nature conservation and provision of 'pro-poor' ecosystem services in specific environmental and socio-economic settings. With this in mind, and to add to the global pool of knowledge on farming-biodiversity linkages, a study was carried out to improve the understanding of how agricultural intensification in a poor and densely populated developing region in southern Uganda affects the abundance and species richness of woody vegetation and birds.

The local context

The study area straddles the equator in an area that was mainly tropical moist forest in the past. Cooking bananas, sweet potatoes, cassava, coffee (with maize in some places) are the dominant crops in terms of area covered. They are frequently mixed in what is commonly referred to as the coffee-banana system. Trees are often abundant on and around farms. Natural habitats are characterized by a high abundance and species richness of birds and trees, while populations of large mammals have been largely eliminated over the past century. The following characteristics suggest a very high current and future pressure on biodiversity resources. Human population densities are high and increasing rapidly (around 3% p.a.): in 2015 most localities will have more than 100 persons per square kilometre and many above 400 persons. Urban markets for food and wood products (timber, charcoal) are expanding and are easily accessible in most places. Crop yields per unit area are low and generally stagnant. Non-farm income is less important for rural

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livelihoods than in many other African regions, implying high dependence on local natural resources.

Data and methods

Agricultural intensification obviously affects different species of birds and trees in quite different ways, and they had to be classified accordingly. Trees were classified into native and exotic species, while birds were grouped according to specialisation (particularly with respect to their dependence on trees/forest) and conservation status.

Data were collected on land use, woody plants, and birds in 14 study sites in crop-based farming systems in the western and central regions of Uganda. The sites differed with respect to the intensity of land use (share of total farm land occupied by crops) and the scale of farming (smallholder farms versus commercial plantations). Most were selected among existing long-term monitoring sites and a few were new sites. This design allowed for both cross-sectional and time-series analysis. A novelty of the study is the use of data collection methods that have rarely been combined: surveys of agricultural land use and land cover, combined with surveys of woody vegetation and birds.

Agricultural land use was characterized principally through different measures of cultivation intensity and secondarily through crop diversity and cropping patterns. Biodiversity was assessed by the occurrence of different tree and bird species. Data on tree species were captured from 20m radius plots, placed 50m apart along the transect, while the occurrence of birds and their relative abundance were surveyed by Timed Species Counts. We used predictive modelling and scatter plots (regression analysis of cross-sectional data was of limited use due to the small number of study sites) to examine the relationships between land use and biodiversity variables.

One limitation of the study is the small number of study sites surveyed (that moreover are stratified into small-scale and large-scale systems); a minor weakness is the basic characterization of larger-scale land use patterns around the sites. A larger, ongoing research project modelled on the current one is developing further these and other elements of the research design.

Results

The large-scale farming systems had very uniform land uses, while there was considerable variation in land use variables among smallholder sites. The cultivation intensity (area with crops / area with crops and fallow) was 1.00 in all four large-scale sites, and ranged between 0.26 and 0.98 in the eight smallholder sites. Land in smallholder sites in central Uganda is more intensively exploited than in the west. This may be attributed to the differences in market access and population density between the two regions. Similar patterns were found for other indicators of high land use intensity – short fallow period, low proportion of natural vegetation, and dominance of mono cropping. All large-scale sites were mono cropped, as expected. Mixed cropping dominated most smallholder sites; the proportion of mono crop in the total cultivated area ranged between 0.20 and 0.78 for these sites. Land use in the smallholder sites was dominated by a few staple foods, notably bananas and root crops (cassava and sweet potatoes) that together made up between 25% and 83% of total cropland. Maize was important in two sites. Coffee, Uganda's largest export crop, on average only covered 10% of cropland, while cotton dominated one site. This confirms the common observation that Ugandan smallholders are mainly subsistence oriented, although some of the food crops may also be sold.

We recorded a total of 270 woody plant species in the 14 sites, of which about 70% were native species. As expected, large-scale agriculture was associated with a considerable loss of woody plant species richness compared to smallholder farming, especially for native species. Results also indicated that woody biodiversity is not only affected by the scale of farming but also by farm ownership; large blocks of cotton fields operated by small farmers thus showed higher species richness than commercial plantations. For the other smallholder sites, a negative relationship between cultivation intensity and woody species richness was only found at the extreme ends of the cultivation intensity gradient. We found similar patterns for woody canopy cover.

A total of 241 bird species were recorded, representing 24% of the total for Uganda and 40% of the birds living in that part of the country. All the bird species are indigenous. The Angola Swallow, Common Bulbul, African Thrush, Grey-backed Camaroptera, and Bronze Mannikin were found at every site, while 69 species were recorded from only a single site. There was a very low presence (ten or 5%) of Uganda's forest specialist species, and mostly in very small numbers. This confirms observations that these species are, as expected, unlikely to survive outside forests.

Time-series analysis provided little evidence for a decline in birds, at least over the last 8–15 years, in the agro-ecosystems with highest biodiversity (less intensively cultivated smallholder farms). Yet when comparing across study sites, we found strong evidence that species are progressively lost (with only a few gains) as agriculture is intensified. Losses are greatest amongst the more specialized species, which are also those of greater conservation concern. Large-scale plantations had much lower levels of biodiversity than smallholder farms. (Time-series data were not available for large-scale systems.) The comparison of predicted (based on original natural vegetation) versus actually recorded bird species showed a significant negative effect of smallholder farming on birds, especially with regard to forest specialists species, and a much larger negative impact of large-scale agriculture. The effect was bigger for high-intensity smallholder farms compared to low-intensity farms, except in the case of generalist species. Large, charismatic species such as the Long-crested Eagle, hornbills and parrots, were scarce or absent from high-intensity cultivations.

Whilst all trees are important for birds, we found strong evidence that native species support a larger numbers of birds than exotics. It is likely that native trees provide more food for birds, while exotics may be just as good for roosting, and possibly nesting. Farmer preference for planting exotics, especially eucalyptus and pine, seems likely to cause a decline in many important bird species. We were not able to examine the importance to birds of different spatial patterns of woody vegetation, but higher degrees of patchiness – i.e. clumping – are likely to be beneficial.

2. Principles for a code of conduct for the sustainable management of mangrove ecosystems: a work in progress for public discussion

Presented by Thomas Nielsen⁴⁴

The Principles for a Code of Conduct for Sustainable Management of Mangrove Ecosystems is a guide to assist states, local and national non-governmental organizations and other stakeholders to develop cooperatively local codes, laws and/or regulations to protect mangroves and the critical functions they serve with regard to contributions to local livelihood, biodiversity conservation and coastal protection through sustainable management.

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The objective is to help bring attention to the importance of mangrove ecosystems, particularly to policy makers, to help arrest and reverse their loss. The Principles, being a work in progress, are being discussed in a range of forums that involve representatives from governments, NGOs, multilateral organizations, research institutions, grassroots organizations and other interested individuals and groups. The Principles were formulated based on a review of global mangrove management experience, about fifteen country case studies from all regions where mangroves exist, and seven regional workshops to date. The purpose of the presentation at this ReNED forum is gain additional feedback from researchers, in particular, to provide input on the content of the Principles. The Principles and many of the background documents and summaries of the feedback from workshops conducted to date can be found on the following website:
http://mit.biology.au.dk/cenTER/MCB_Ph2_ToR.htm

3. Deforestation and biodiversity: Effects of bush land cultivation on dung beetles in semi-arid Tanzania

Presented by Sofie Tind Nielsen⁴⁵

Not much is known about how deforestation and conversion of formerly wooded habitat into annual cropping affect functionally important insect groups including dung beetles (Coleoptera: Scarabaeidae). The tunnelling behaviour of dung beetles increases the soil's ability to absorb and hold water, and their dung-handling activities enhance soil nutrient cycling. Consequently, these beetles are particularly important in arid environments. This study seeks to understand the differences in dung beetle diversity and community structure between bush land and cultivated land in semi-arid Tanzania. Dung beetles were sampled in the two habitat types using baited pitfall traps. The species richness was higher in the bush land sites than in the cultivated sites. The numbers of trapped specimens in the two habitat types were not significantly different. Cluster analysis on dung beetle assemblages showed two distinct species compositions for the two habitat types. Some species appear to be very habitat specific. Especially the rollers showed a preference for the wooded habitat, with significantly higher species richness in the bush land habitat than in the maize fields. Also it was noticed that the large beetles overall seemed to be more abundant in the bush land habitat than in the maize field habitat. In conclusion, the bush land fragments appear to have an important conservation value as to maintaining the high diversity of dung beetles and thereby the ecosystem services that they provide.

4. Medicinal plant diversity in the community of Pulquina, Municipality of San Lucas, Nor Cinti Province, Chuquisaca Department (Bolivia)

Presented by Karen Amaya Vecht⁴⁶

This study investigated the medicinal plant diversity in the Quechua peasant community of Pulquina. In this community most people use medicinal plants, reporting medicinal information for 140 medicinal plant species that represent 49 plant families and 109 genera, having most of them been reported previously by different authors as having medicinal uses. The most important family in terms of number of species was Asteraceae followed by Solanaceae, characteristic of dry Andean

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valleys. The most frequent life form used was herbs and the most used part of the plant was the leaves and the whole plant mainly in fresh state. The remedies were mainly prepared as infusions followed by cataplasms and “horchatas” and mostly administrated orally or by direct application. The overall most important and preferred species in terms of percentage of informants mentioning them and by their MUV were *Mimulus* sp. and *Citrus aurantiifolia*. Part of the knowledge in the community is shared with other Andean and non-Andean communities due to the consistency in the use of some species; however, the other part of the knowledge must have been developed through the years to satisfy a specific health problem that was not solved with the modern health system.

The wide array of medicinal plant species are used to cure or alleviate 94 different sicknesses, ailments, diseases or health problems. The most important categories in terms of number of sicknesses or ailments and number of species that cure these are the ‘unspecific symptoms or component of sicknesses’ (e.g. fever, infection), the ‘digestive system’ (stomach-ache, diarrhoea) and the ‘popular belief system and/or magical connotations’ (“asustados”, “cólera”, “wayra”). Most species have their origin exclusively in South America or in the Americas, although there is a fairly high number that have been introduced. Most species used were collected from the near surroundings in both private and communal grounds mainly growing wild, and most are not cultivated. Both men and women have a good knowledge in relation to their plant resource, but the medicinal plant specialists or traditional healers in Pulquina are the “jampiris”. They are in charge of providing health care to the people using medicinal plants and different divinatory or revelatory techniques that have both local indigenous and Roman Catholic elements during their practice. Their knowledge is mainly transmitted from generation to generation. Most people in the community would consult them first if someone in their family became sick, finding also a high percentage of people that would first cure themselves if the sickness was not too serious or special. The knowledge common people possesses concerning medicinal plants is also transmitted from generation to generation in an oral and empirical way. People in Pulquina believe that they will continue to use medicinal plants in the future as they consider this resource part of their culture plus the fact that they consider it important as it is affordable, effective and an available mean to cure them from the common sicknesses they suffer.

5. Using biological diversity to monitor the quality of the most important ecosystem service of all – freshwater! Experiences and perspectives from developing countries

Presented by Dean Jacobsen⁴⁷

Streams are numerous in equatorial parts of South America because of the high amounts of rain. However, this water resource is threatened by the quickly growing population, the intensified agricultural practices and the increased industrialization. For example, only 2 % of the wastewater is treated before being discharged. In other words, water resources are currently deteriorating in the third world, while water quality is improving in many developed countries, following the lack of environmental responsibility in the past. Degradation of water quality leads to loss of biological diversity. The bad water quality furthermore constitutes a major health risk and a main cause of spreading of diseases. It also increases poverty, because in the tropics people often use streams for fishing, washing, bathing, irrigation and in some cases even as drinking water. Obviously, polluted streams are inappropriate for these uses.

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All major environmental organisations (e.g. UNEP, IUCN and WWF) have protection and assessment of freshwater resources among their highest priorities. Most developing countries are aware of the situation and interested in implementing monitoring programs. In most economically rich countries (e.g. the EU) stream quality is routinely monitored using the diversity and community composition of aquatic macroinvertebrates as biological indicators, because of the many advantages of this approach. Biological monitoring with macroinvertebrates is particularly appealing for developing countries too because accurate information can be obtained at a fraction of the cost and equipment required in chemical approaches. However, developing countries rarely have biotic indices adapted to for their local stream fauna and will often need to seek know-how from countries with the relevant long-term experience to develop such tools.

Taxonomical knowledge of the fauna is often limited in developing countries, and species level identification is usually impossible. In contrast, family identification pose few problems, and bio-monitoring could therefore be based on family level methods, either by creating completely new indices or by adapting existing ones used in other regions. For example, I have found that the British ASPT family level index, worked quite well (i.e. reflected water quality satisfactorily) in Ecuadorian highland streams. Biological monitoring is, if any, a field were biodiversity and auto-ecological knowledge is used to monitor the quality of an extremely important ecosystem service: Freshwater. Therefore, this field of research deserves much more attention that is currently the case.

6. Legal framework for protection of environment and conservation of biodiversity in Iran and its shortcomings

Presented by Mahmoud Jalali⁴⁸

Peace, development and environmental protection are interdependent and indivisible.

International environmental law is defined as the principles and rules of international law relating to the protection of the environment. However, in a broad sense it is rightly argued that ‘all human activity affects the conditions of our natural environment’ and as such ‘all principles and rules of international law are environmental’. As environmental concerns becoming increasingly central to the international community, international law imposes limits on the rights of States and other members of the international community concerning their environmental activities. This is because international legal system has to address national, regional and global environmental challenges. Since the land, the sea and the air-spaces of planet Earth are shared, acid rain, ozone depletion, loss of biodiversity, climate change, toxic and hazardous wastes, pollution of rivers and depletion of freshwater resources are some of the said challenges the international community must tackle. Moreover, environmental threats do not respect national boundaries. Issues previously considered being matters of domestic sovereign concern, have now international implications. However, these problems can only be overcome through international co-operation of individual States and domestic implementation of environmental standards. Therefore, the adequacy of a national legal system is judged by its ability to protect and preserve the environment. Iran is no exception to this rule.

Generally speaking, environmental awareness has cultural, religious and historical significance in this developing country. Respect for the living environment is emphasized in much of its traditions.

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Cultural values, especially those inspired by religious teachings, have always given prominence to employing reason and common sense when dealing with the wealth of nature. Article 45 of the Iranian Constitution, maintains natural resources to be natural treasures, Infal. On the basis of the first verse of the Infal chapter in the Holy Quran, Article 45 maintains the ownership of regions such as forests, rangelands, seas, rivers, mountains and valleys as belonging to God and His Messenger, and thus warns about the destruction of these national natural resources. Also, Article 50 of the Constitution provides that in Iran 'it is considered a public duty to protect the environment where the present and future generations are to have a thriving social life. Thus, any form of activities, whether economic or otherwise, that causes pollution of or irreparable damage to the environment is prohibited.' These traditions and Articles have been instrumental in establishing an environmental legal framework and resulted in a relatively comprehensive set of laws and regulations being developed and tailored to meet emerging environmental problems facing the country. The major Iranian environmental legislation includes Environmental Protection and Enhancement Law; Pastures and Forestry Law of 1974; National Clean Air Act 1975; 1967 Game and Fish Law; The Plant Protection Law of 1967 and The Forest Law.

The variety in the climatic conditions of Iran is striking. It features enormous deserts, several mountain ranges, a huge plateau, and large forests and on a daily basis, temperature variations of 40 degrees are recorded within its borders. It supports more than 7,000 plant species of which 20% are endemic, 500 species of birds and 148 species of mammals. For this reason, it has been in the forefront of biodiversity conservation. By the coming into power of President Khatami in 1997 and considering the vital role of biodiversity for sustainable development, strengthening of the national environment machinery, enhanced regulatory standards, more efficient monitoring, greater public education and public awareness of the entire spectrum of green issues became hallmarks of a new era. To take few examples, the third National Socio-Economic and Cultural Development Plan (2000-2004) included two major paragraphs (104 and 105) and several subparagraphs on environmental issues. These paragraphs addressed issues as sustainable exploitation of natural resources, environmental liability and redress, support of green industries, as well as Environmental Impact Assessment (EIA) Convention. Also, the Fourth Development Plan (2005-2010) while endorsing the content of paragraphs 104 and 105, devotes the entire chapter 5 (Articles 58 to 71) to the environmental issues. In Article 107 the Plan provides that 'all the large production and service providing projects must, in the process of the feasibility study and before execution, be assessed from the standpoint of their impact on the environment, on the basis of the criteria that will be proposed by the High Council for Environment and approved by the Cabinet. The persons in charge of execution of the projects are required to observe finding of the assessment...' The Plan, also, embraces preservation of biodiversity and its enhancement to the global standards levels (Art. 58), environmental education, prevention of air pollution in major cities and establishment of a National Fund for Environment (Article 68). The Fund was recently set up in July 2005.

As to the international aspects, apart from a number of bilateral treaties concluded with different States, the international convention for the protection of wetlands was formulated at the Iranian city of Ramsar on the Caspian coast in 1971, and is accordingly named the Ramsar Convention. Also, it ratified the 1992 Convention on Biological Diversity in 1996. The main objectives of the Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Benefiting from its Islamic values, Iran has also moral obligations for biodiversity conservation. According to the mentioned values, the human beings are responsible for preservation of the natural heritage. In accordance with the objectives of the Convention on Biological Diversity envisaged in Article 6, and with the financial support of the Global Environment Facility (GEF) and the technical support of the International Union for the Conservation of Nature and Natural Resources (IUCN), Iran's Department of Environment (DOE) which was set up in 1971, has started a project with a budget of \$350,000, for preparation of the 'national biodiversity strategy and action plan'. To this end, the country has so far published several reports.

However, despite many developments in the field of environment, recently it was declared by the Head of the DOE that there is annually some US\$ 4,800,000,000 the worth of damages to the Iranian environment. Some 200 tons of dust and 450,000 tons of lead resulting from fuel consumption and other oil-product related materials are added to the pollution of air in the cities every year. The capital city, Tehran, suffers from all kinds of pollution including air, soil and noise. According to the World Health Organization (WHO), it is one of the most polluted cities of the world. The carbon monoxide pollution in Tehran is more than six times the acceptable level set by the WHO. Due to many reasons including the effects of the 8-year war between Iran and Iraq and the leaking of oil, the pollution in the Persian Gulf is 70% more than any other similar sea in the globe. The Caspian Sea is disappearing in pollution and due to excessive amount of pollution no natural evaporation is taken place in this lake. Obviously, the impact of these on biodiversity and on plant and animal resources is undeniable. For instance, the waters of the Caspian Sea are so contaminated that the Caviar a source of energy is becoming almost extinct. Some species of birds and plants no longer exist in Tehran. In addition to deforestation and desertification issues across much of Iran, the rapid population growth over the past 20 years (70,000,000) and the mismanagement of the economy and industrial wastes have been significant factors contributing to Iran's environmental problems too.

In the light of all these, Iran's biodiversity and ecosystem is in urgent need of protective measures. Iranian rules of environmental protection are a marginal part of its existing legal system. The country must fill the existing legal gaps by legislation. For instance, at present there is no law on noise pollution. Also, contribution of the civil society institutions in environmental issues such as NGOs must be welcomed and supported by the Government. As the country lacks enough training, scientific skills and up-to-date knowledge on environmental issues the establishment of an independent Research Centre on Environment can play a major role for the country. Also, there is a need in Iran to clarify the complexities involved in protected areas in relation to biodiversity protection. For the current national and international conventions concerned are not always well defined.

In sum, as the conference aims at contributing to the understanding of the importance of biodiversity and ecosystems in developing countries, this work addresses a topic in relation to one of the five key concerns of the Conference namely how Iran as a developing country has developed and maintained its environmental institutional legal capacity and monitoring system regarding biodiversity and other topics concerned. Also, by analyzing the causes of successes and failures in the system, the many shortcomings of the Iranian mechanism of biodiversity conservation and environmental protection is illustrated.

7. Scale and aquatic ecosystem management in the lower Mekong basin

Presented by Thomas Augustinus⁴⁹

The fishery of the Lower Mekong Basin (LMB) is one of the most diverse and productive river fisheries in the world. The average person in the LMB consumes 36 kg of fish/year, making fish a staple in the local diet as well a source of cash income (MRC, 2003). While there are some large scale fisheries, especially on the lower parts of the LMB, most fishing activities are small scale, part time and to a large extent subsistence-oriented.

Many of the LMB fish migrate vast distances as their lifecycle instinctively makes them swim between different habitats, essential for the survival of their species. This migration influences people's livelihoods in space and time as people will organise their way of living, according to the presence and abundance of certain fish species. Frequently, one livelihood activity will substitute another depending on the timing and abundance of the aquatic resource. Conversely, the lifecycles of many fish are dependent on the flow of water and the state of key habitats, often influenced by human activities.

The Mekong River Basin's aquatic resources are managed by a variety of organisations operating on different administrative levels, creating a complex interplay between ecological processes and forms of social organisation. This poster will explore the challenges that occur in trying to match management organisations and the scale at which decisions are made, with the scale at which ecological processes occur. By drawing on experiences from the Mekong River Commission's (MRC) Fisheries Program and research activities under the Challenge Program for Water and Food (CPWF), the poster will illustrate that temporal and spatial scale issues are essentials to be addressed in aquatic ecosystem assessments and management. Moreover, experiences show that co-management is a process that can bring together local resource users and government institutions, creating the legitimacy necessary for effective management interventions that ultimately enhance ecosystem services.

8. Environmental and spatial controls of palm (Arecaceae) species distributions at local to regional scales in neotropical forests

Presented by Adriana Sanjines Asturizaga^{50, 51}

Co-authors: Jens-Christian Svenning⁵⁰, Signe Normand⁵⁰, Jaana Vormisto^{50, 52} & Henrik Balslev⁵⁰

The forces that structure beta diversity (spatial turnover in species composition) in tropical forest plant communities are controversial. One tradition emphasizes environmental differences, while a more recent contrasting view suggests that spatial turnover is the product of species neutral dispersal limitation and demographic stochasticity. The latter view predicts that similarity in species composition should decay with geographic distance independent of environmental differences. During the last 10 years we have explored this issue by examining spatial patterns in species composition of palm communities in lowland forests in the western Amazon basin and Central America (Panama) and mountain forests in the Andes. At local to landscape scales (extent < 10 km)

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we have often found topography (hydrology) to be the most important environmental control of species composition. At some sites past human land-use is also very important. At regional scales (< 1000 km) soil factors appear to be the most important environmental controls. However, at all scales geographic distance or other spatial patterns generally appeared as independent controls of species composition of at least equal strength to the environmental factors combined. We interpret these patterns to suggest that Neotropical palm communities are assembled through the interaction of local environment conditions and dispersal limitation.

9. Local knowledge of tropical rainforest palms in the Pastaza Fan in the western Amazon Basin

Presented by Henrik Balslev⁵³

Co-authors: Narel Y. Paniagua Zambrana^{53, 54}, Monica Moraes⁵⁴, Cesar Grandez⁵⁵ & Anja Byg⁵³

Local knowledge of the natural environment increasingly attracts the interest of those who promote sustainable use of natural resources. Local management systems are seen as sustainable because they have stood the test of time and have evolved within a social and natural context, which they are therefore adapted to. In addition, resource use schemes building on local systems and values have a higher chance of succeeding than others. Palms are an important element in local management systems in wet tropical environments and are therefore a useful starting point for resource use schemes building on local knowledge. In this study in Amazonian Peru; we recorded uses for 29 species of palms and these uses were quite diverse and could be classified in at least 33 different categories. However, local knowledge often exhibit considerable variation along social, economic, gender, and cultural gradients. This was also seen in this study where there were significant differences in number of uses and palms known by the people interviewed among the six villages visited (ANOVA, $p < 0.0001$), by informants from different ethnic groups and settlers ($p < 0.0001$), by older and younger informants ($p = 0.0166$), by those with longer and shorter formal school training ($p < 0.0001$) whereas the difference in palm knowledge of men and women was insignificant ($p = 0.5918$). The myth of the noble savage who knows every detail of his natural environment does not hold; local knowledge among rainforest inhabitants vary considerably and those who travel and study more may become the wisest even if they are settlers in the ecosystem. Local knowledge remains a promising and little exploited resource for the development of sustainable use systems, but to tap it requires understanding of its uneven distribution among those who possess it.

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Working group sessions (parallel sessions 3a-3c)

Working group briefs

After the presentations in the parallel sessions, the three groups were given the brief to discuss and provide recommendations within for three types of ecosystems:

- 3a. Marine and Coastal Ecosystems (chair and rapporteur: Donald Macintosh)
- 3b. Humid and sub-humid tropical forests (chair: Phyllis Coley; rapporteur: Simon Bolwig)
- 3c. Savanna ecosystems (chair Anette Reenberg; rapporteur: John Balarin)

The discussion addressed the five key concerns of the conference: (see also the introduction):

- 1. The importance of biodiversity for maintaining the quality and quantity of ecosystem services
- 2. The value of biodiversity in relation to ecosystem services
- 3. Sustainable financing mechanisms and community based management systems - appropriate payment systems and institutional set-ups
- 4. Biodiversity and ecosystem service monitoring
- 5. Institutional capacity and good governance

The groups then prioritized ideas for new research and development assistance within each - or a selection – of these.

Working group results

The time for group work was relatively limited and several of the groups did not only discuss the problems in relation to a specific ecosystem system. Therefore, the following summary of the discussions and recommendations of each group is to a large extent of a more general nature.

Group 3a (Marine and coastal ecosystems)

1. The importance of biodiversity for maintaining the quality and quantity of ecosystem services

Existing knowledge should be collated and “re-packaged” in forms more suitable for decision-makers and general users.

Rather than promoting more research *per se* there should be activities to better inform decision-makers about coastal ecosystems, combined with effective monitoring and feedback mechanisms. Aspects of this approach are researchable, as well as being fundamental to improving development assistance.

There is a lack of knowledge at the ecosystem level, especially the role of certain organisms in ecosystem functioning, and new research should be directed here. In particular, the impact of removing certain species for economic use needs to be researched.

2. The value of biodiversity in relation to ecosystem services

This is a subject of high priority for research. “Valuation” at the species and ecosystem levels needs to be defined in its full sense, meaning not only direct economic value, but also indirect (off-site) values and social and cultural values.

Valuing biodiversity requires an interdisciplinary approach in research, involving both economists and natural scientists working together.

3. Sustainable financing mechanisms and community based management systems

Ecosystem goods and services are, in many cases, not part of the formal economy and therefore they are not properly regulated and taxed (most coastal and marine resources are exploited on an open-access basis).

Research is needed to identify and analyze the ecosystem services being exploited and the links between different user groups.

Threats to biodiversity and ecosystem services should be identified and “mapped” in terms of their source, scope and potential impacts. External threats to the coastal zone are particularly important to research, as the recent Asian tsunami dramatically illustrated.

Community based management is still not well developed in coastal and marine environments. Research into community management systems, including contracted resource management (e.g. stewardships), partnerships and co-management approaches is considered a high priority, given the dense population pressure and resource limitations in the tropical coastal zone.

Research is needed to identify, test and study mechanisms to diversify tourism revenues in order to increase the benefits to local communities from tourism. Conversely, it is also important to research the impacts of tourism on the marine and coastal environment, including negative impacts on the environment and local communities.

Research into the validity of “willingness to pay” as a method of valuing marine and coastal services is recommended.

Mechanisms to involve marine related tourism should be explored in particular mechanisms to raise industry contribution to MPA operations with inspiration from for instance the wildlife sector, e.g. the way National Parks and Wildlife in the South Africa has outsourced management of game reserve to local tourism operators.

4. Biodiversity and ecosystem service monitoring

Monitoring activities should cover past, present and future situations. Accessibility of information from monitoring (including baseline studies) is considered very important, therefore use of the internet is strongly recommended as a means of making such information widely available for future use.

Research is required to develop methods of integrating scientific and community based monitoring of marine and coastal ecosystems (there are some good examples of community based monitoring e.g. in marine protected areas).

The objectives of monitoring should be clearly identified before monitoring systems are designed. In particular, many countries are setting up marine and coastal protected areas without fully defining their functions and objectives.

Standardization of monitoring systems is required, especially for marine ecosystems and mangrove ecosystems. Reef base is an example of a good multi-level information and monitoring system that already exists for coral reefs.

5. Institutional capacity and good governance

In general, coastal ecosystems have poor governance and conflicts between user groups are widespread. Institutional mandates are often overlapping or unclear; and the legal framework is usually very complicated, but weakly enforced.

There is a “knowledge gap” among decision-makers as to how marine and coastal ecosystems function and therefore how institutional management should be structured and implemented. As recommended in concern 1, existing knowledge should be re-packaged to make it more accessible and usable for decision-making.

Research into the development of management plans for marine and coastal protected areas in developing countries is a high priority.

Links between formal and non formal management structures should be researched with the objective of making them more visible and effective. This may include regional and local government structures versus Dept. of Fisheries and local committees established by projects and NGO's.

Group 3b (Humid and sub-humid tropical forests)

The group initially discussed the communication between different disciplines as there seemed to be a gap between social science based studies on human use of biodiversity and more natural science based analysis of the functions of biodiversity. It was agreed that further communication of results across disciplines is needed. The group discussed the following issues:

1. Capacity building

There is an urgent need to enhance capacity for research and development in developing nations. Training and infrastructure must be provided for these countries to gain economic benefit from sustainable uses of their biodiversity such as:

- Bioprospecting
- Ecotourism
- (Sustainable) agricultural research
- Biodiversity research

Training of local people in identifying and monitoring selected biodiversity and ecosystem indicators is important. Capacity development of researchers and government agencies to ensure attention to small and marginal farmers is needed.

2. Research needs

More empirical documentation of why biodiversity is important for ecosystem services is needed, for example:

- Diverse natural forests for water supply
- Dung beetles (and many other small animals = biodiversity!) for nutrient cycling and soil building in agriculture
- Income from a variety of NTFPs

- Crop diversity for farmer income stability
- Multi-species bio-control of pests and diseases
- Biodiversity gains in production systems that are linked to poverty reduction and improved livelihood – research in biodiversity hotspots on ecoagriculture development needed

Correlations between biodiversity and ecosystem services (at larger scales) need to be established through experiments and other intensive research methods to identify the nature and direction of causality (if any) implied by the statistical relationships presented. A better empirical foundation of the value of ecosystem services known to depend on biodiversity is also needed as are improved biodiversity-based indicators for measuring and monitoring the state or quality of ecosystems.

Strategies and models for conservation of biodiversity in densely populated areas where (peri-urban) agricultural land use is typically very intense

- Zoning, micro habitats, wildlife corridors, participatory management, etc.
- Challenge: trade-offs are very high

Which species might realistically survive in intensely cultivated areas and how? How do we minimize trade-offs between conservation of such species and the provision of ecosystem services, which may be more important for local economic welfare, especially for agricultural production?

Synergies must be explored, e.g., conservation of natural predators to pests and promotion of pollinators, and the biological interaction between cultivated lands and adjacent natural landscapes need to be analysed. There is a need to explore how biodiversity conservation may contribute to reduce poverty and improve livelihoods. High value organic agriculture in biodiversity hotspots could be one solution and better markets for Non Timber Forest Products (NTFP) another.

Research on sustainable agriculture is important and farming systems should become an essential part of any biodiversity conservation strategy. Danida was urged to focus on agriculture again, e.g. poor people's agriculture and links to biodiversity conservation.

3. Payments for environmental services (PES)

PES can provide needed economic incentives for conservation, but under which conditions are PES viable and appropriate and for which services? 'Best bet' local institutions and management systems (e.g. for nature-based tourism) that support local people and at the same time conserve biodiversity need to be developed.

4. Policy and research

The policies and related programmes that are most important for biodiversity in specific countries need to be identified. PRSPs are important policy instruments but often environment is not adequately considered. Biodiversity and other environmental concerns need to be integrated and mainstreamed in such policy documents.

The appropriate use and application of biodiversity and ecosystem research by policymakers, development practitioners, beneficiaries and local people need to be addressed in development programmes, including how research may contribute to empower local people with regard to conservation of biodiversity and of locally important ecosystem services.

Group 3c (Savanna ecosystems)

The group discussed five issues of which some were dealt with in more detail:

- Biodiversity and ecosystem services
- Value of biodiversity
- Community based natural resource management (CBNRM)
- Monitoring
- Institutional aspects

The lessons learnt from history of CBNRM need to be captured. Colonial governments tried to manage the environment in Africa and elsewhere based on their European experiences. Later the ideas of CBNRM were developed by Europeans and Americans and research is needed on whether CBNRM – now being implemented in Africa - actually works in the West.

Economic valuation should be employed to make informal elements of NRM more formal. Much can be learned from other sectors and systems of taxation to promote ‘user pays schemes’ and appropriate use of revenues need to be developed. To make such systems work, governance issues have to be addressed: Government hierarchies should protect tenurial rights, ensure equity, protect user groups, avoid corruption, and consider differences between customary and modern institutions. Moreover, enforcement of laws can be a major problem because of lacking resources and corruption.

Conclusions and recommendations

The final session of the conference was composed of a discussion of the conference presentations and the working group results as well as concluding remarks. The final conclusions and recommendations of the conference are summarized in the following:

Information sharing and collaboration

A need for repackaging existing information to enhance communication across disciplines and to development practitioners has been identified. Better interaction between e.g. biologists and economists is needed as economic valuation is becoming increasingly important as an instrument to address the possible economic benefits of biodiversity conservation. This is underlined in a new publication of OECD-DAC on market-based mechanisms for creating a better environment, with examples of tax-based economies.

It is essential to convince politicians of the need to support long term research projects as interdisciplinary collaboration otherwise is difficult to achieve. Networks of ENRECA projects should be established as part of the work of the Danish Research Networks.

Develop focal points where researchers and development practitioners can meet and analyse the most relevant issues to be addressed. The different types of knowledge contained within both groups are necessary for adequate decision-making and for making knowledge available to the right people.

Research and development assistance needs

A number of research needs were outlined by the working groups (see above). What emerged to be of key interest and reiterated under the final discussion were:

- The dependence of ecosystem services on biodiversity need to be better understood. There are studies and experiments carried out in the North, but these need to be repeated in the south.
- Co-existence of people and nature – what kind of biodiversity can survive in the long term in areas with high population densities?
- Billions of dollars is spent on conservation projects, but there is very little empirical evidence to support that conservation, e.g. in protected areas (PAs), actually protect biodiversity better than outside PAs. Controls in areas without conservation are needed to assess the impact of projects, though bearing in mind that it in some cases can be difficult to wait for controls if a population of a certain species is being decimated. For this purpose, appropriate systems and levels of community involvement in monitoring must be designed to avoid unrealistic workloads of local participants in projects.
- Eco-tourism should have had a better representation in the programme as it is a very important activity directly aimed at biodiversity conservation. Research on impacts of tourism, locally and globally, is still needed.
- Linkages between the rapid urbanisation in many developing countries, ecosystem services and biodiversity conservation were not addressed by the conference. This is partly related to the discussions on biodiversity in highly populated areas, but aspects such as increasing demand for services from urban populations need to be dealt with further.

- Strengthen developing country capacity for research and development on the potential of biodiversity to support livelihoods, particularly through participatory research
- Research in biodiversity hotspots on interactions between land use systems and wildlife habitat and species needed
- Support institutional research as well as local communities' own research capability on the role of crop varieties, and fish and livestock races in the ecosystem of importance to the poor – including how less well-known varieties can be integrated into the local ecosystem
- Develop programs to educate farmers, agricultural researchers and agriculture policymakers in ecosystem management and programs to educate wildlife biologists, ecologists and conservation policymakers in agricultural resources and farming systems management

Funding

Considerable funding was promised at the World Summit for biodiversity conservation – it would be useful if ReNED could look into this and alternative funding sources. Available funding for research within development assistance is limited, though research activities in sector programmes and capacity development activities in the ENRECA programmes provide good platforms for research collaboration between South and North, including joint development of larger research proposals to be funded by research councils or private foundations.

Publication plans and follow-up

The organising committee of the conference will approach the international journal Biodiversity and Conservation for possible publication of a selection of the papers and posters presented at the conference in a special issue.

Closure of the conference

Before the closure of the conference, the chairman of the final session, Gábor Lövei, and Anette Reenberg (Chairman ReNED Board) thanked the organising committee and the ReNED secretariat for organising a productive conference and all the speakers and participants for contributing with interesting data and discussions.

Annex 1: Conference programme

Wednesday 17 August

08.30-09.00	Registration and coffee/tea	
09.00-10.40	Session 1. Chair: Ivan Nielsen , Department of Biology, University of Aarhus	
09.00	Welcome and Introduction to the Key Issues of the Conference	Ivan Nielsen , Associate Professor, Department of Biology, University of Aarhus, Denmark.
09.15	<i>“Danida Strategies and Approaches to Biodiversity Conservation and Ecosystem Management”</i>	Henning Nøhr , Chief Technical Advisor, BFT.2, Danish Ministry of Foreign Affairs
09.30	<i>“Nature Supporting People: the Southern African Millennium Ecosystem Assessment”</i>	Belinda Reyers , Environmentek, Council for Scientific and Industrial Research, South Africa
09.55	Discussion	
10.10	Coffee/tea	
10.40-12.30	Session 2. Chair: Sanit Aksornkoae , Thailand Environment Institute	
10.40	<i>“Linking Bioprospecting with Sustainable Development and Conservation: The Panama Model”</i>	Phyllis D. Coley , Professor and Thomas A. Kursar , Associate Professor, Department of Biology, University of Utah, USA
11.05	<i>”The Relationship between Biodiversity and Population Centers in Developing Countries”</i>	Jon Fjeldsaa , Professor, Natural History Museum, University of Copenhagen, Denmark
11.30	<i>“Ecosystem Valuation: Linking Biodiversity Conservation to Human Welfare”</i>	Subhrendu K. Pattanayak , Senior Economist, Research Triangle Institute, NC, USA
11.55	Discussion	
12.10	<i>“Commissioned Review Paper: Research on the Relationship between Ecosystem Services and Biodiversity”</i>	Cecil Konijnendijk , Woodscape Consult, Denmark
	Introduction to parallel sessions and posters	
12.30	Lunch and poster viewing	

13.30-15.00	Parallel Sessions	
13.30-15.00	Parallel Session 3a. Marine and Coastal Ecosystems. Chair: Donald Macintosh , Department of Biology, University of Aarhus	
13.30	<i>"Mangroves.... The "Life-Saving Belts" of Coastal Areas in Thailand"</i>	Sanit Aksornkoe , Professor and President, Thailand Environment Institute
13.45	<i>"Marine Protected Areas as a Mechanism to Support Coastal Ecosystem Services and Biodiversity in Vietnam"</i>	Nguyen Giang Thu , Ministry of Fisheries, Socialist Republic of Vietnam
14.00	Discussion of the five key conference questions in relationship to marine and coastal areas and associated natural resource management systems	
15.00	Coffee/tea and poster viewing	

13.30-15.00	Parallel Session 3b. Humid and sub-humid tropical forests. Chair: Phyllis Coley , University of Utah, USA	
13.30	<i>"Participatory Forest Management for Sustainable Community Development: Lessons Learnt in Conservation and Management of Udzungwa Mountain Forests, Iringa, Tanzania"</i>	John Massao , Senior Forest Officer, Forest and Bee Keeping Division, Tanzania
13.45	<i>"Biodiversity in the Farmscape: Farmland Action Planning for Biodiversity in Thailand"</i>	Kirsten Ewers , Chief Consultant, Rambøll, Denmark
14.00	Discussion of the five key conference questions in relationship to tropical forests and associated land use and natural resource management systems	
15.00	Coffee/tea and poster viewing	

13.30-15.00	Parallel Session 3c. Savanna ecosystems. Chair: Anette Reenberg , Institute of Geography, University of Copenhagen	
13.30	<i>"Community Based Natural Resource Management (CBNRM). Is It the Solution or the Problem to Biodiversity Management in Africa?"</i>	John Balarin , Regional Program Coordinator, Danish Hunters Association, SE Africa CBNRM Wildlife Program, Malawi
13.45	<i>"Grasshopper and Locust Control in Sahel: Biodiversity and Ecological Services"</i>	Niels Elmegaard , Senior Biologist, National Environmental Research Institute, Denmark
14.00	Discussion of the five key conference questions in relationship to arid and semi-arid ecosystems and associated land use and natural resource management systems	
15.00	Coffee/tea and poster viewing	

15.30-17.30	Session 4. Chair: Thomas K. Kristensen , DBL - Institute for Health Research and Development	
15.30	<i>“Correlations between Biological Diversity and the Provision of Water Resources in Africa”</i>	Neil Burgess , Department of Zoology, Cambridge University, UK
15.55	<i>“Maintaining ecosystem services through the conservation of coastal biodiversity: some examples from Southeast Asia”</i>	Donald Macintosh , Professor, Centre for Tropical Ecosystems Research, University of Aarhus, Denmark
16.20	Discussion	
16.30	<i>“Ecosystem Services at the Human Interface, an Interdisciplinary Perspective on Biodiversity and Health”</i>	Jacobien Scherpbier-van Holthe , WHO Consultant, Rural Development Sociologist, France. WHO Environmental Health
16.55	<i>“Biodiversity, Ecosystems Services and Genetically Modified Organisms”</i>	Gabor Lövei , Senior Scientist, Danish Institute of Agricultural Sciences
17.20	Discussion	
17.30-19.00	Informal reception and poster viewing	

Thursday 18 August

09.00-10.00	Session 5. Chair: Helle Munk Ravnborg , Danish Institute of International Studies	
09.00	<i>“Relationships between Institutions and Regulation, Markets and use of Biodiversity”</i>	Henrik Egelyng , Researcher, Danish Institute of International Studies
09.25	<i>“Linking Village-Based and Project Monitoring with National Reporting Frameworks for Biodiversity and Community Based Natural Resource Management”</i>	Tom Blomley , Senior Advisor, Participatory Forest Management Programme, Forestry and Beekeeping Division, Tanzania
09.50	Discussion	
10.00	Coffee/tea and poster viewing	

10.30-13.00	Session 6. Chair and moderator of final discussion: Gabor Lövei , Danish Institute of Agricultural Sciences	
10.30	<i>“The Importance of Scientific Studies for the Understanding and Management of Environmental Services”</i>	Hugo Navarrete , Universidad P. Catolica, Quito, Ecuador
10.55	<i>“Capacity Development Regarding Ecosystem Services and Biodiversity”</i>	Ivan Nielsen , Associate Professor, Department of Biology, University of Aarhus, Denmark
11.20	Discussion	
11.30	Group presentations, 10 minutes each	
12.00	Final discussion and conclusions	
13.00-14.00	Lunch	

Annex 2: List of participants

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Aksornkoae	Sanit	Thailand Environment Institute	sanit@tei.or.th
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