Horst Korn, Katrin Kraus and Jutta Stadler (Eds.)

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Proceedings of the European Conference on Biodiversity and Climate Change 2011 – Science, Practice and Policy –

Bonn, Germany, 12-13 April 2011

Organised by the German Federal Agency for Nature Conservation (BfN) with the support of the University of Greifswald and in collaboration with the European Network of Heads of Nature Conservation Agencies (ENCA)

Compiled by:

Horst Korn
Katrin Kraus
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Cover photo: Adonis Blue (*Polyommatus bellargus*), gathering of males on dung
(© Peter Ginzinger)
While climate change – at least in Central Europe – will probably only have relatively modest impact on the distribution of this butterfly species, the maintenance of extensive grassland management is of central importance.

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Preface

Climate change is arguably one of the most significant conservation challenges of the 21st century. Not only will there be direct climate change with effects on biodiversity but also societal mitigation and adaptation measures may seriously impact on biodiversity. In the light of a changing climate there is a need of adapting conservation strategies, to explore how this should be implemented, and share experiences of putting adaptation principles into practice. There is also growing awareness that addressing biodiversity loss and climate change in an integrated manner can have a range of multiple benefits for society, including synergies with sustainable development goals.

Since neither climate change nor biodiversity stops at national borders, cooperation across Europe, including the exchange of experiences and best-practice examples, will become increasingly important for nature conservation in addressing the common challenge that lies ahead. Against this background, the German Federal Agency for Nature Conservation (BfN) in co-operation with the ENCA Interest Group on Climate Change and with support from the University of Greifswald organized the "European Conference on Biodiversity and Climate Change – Science, Practice & Policy", which took place on 12 & 13 April 2011 in Bonn, Germany. The conference presented the wide range of research questions and challenges with which climate change is confronting European nature conservation. The aim of the conference was to share knowledge and experiences in the field of biodiversity and climate change among European scientists, conservation practitioners and policymakers in a trans-disciplinary manner in order to improve both the integration of research outputs into practical conservation projects, and the identification of further research needs.

With attendance of more than 200 experts from 22 European and four non-European countries the conference provided a broad platform for international information exchange on these issues. 25 presentations covering the above mentioned topics as well as representing a wide range of different geographical regions and habitats within Europe were supplemented by a poster session and a panel discussion summarizing the main points of interest of the conference.

The following proceedings are an attempt to capture the richness of the presentations and discussions. In the name of the organizing team, I would like to thank all conference speakers who produced written abstracts for these proceedings. Thanks too to those who contributed posters.

In preparing this document it is our sincere hope that the important findings of the conference will benefit a wider audience and provide stimulation and guidance for forthcoming activities that will contribute to maintaining the quality of Europe's rich biodiversity, its ecosystems and the vital goods and services that they provide.

Prof. Dr. Beate Jessel

President of the German Federal Agency for Nature Conservation (BfN)

Introduction

The "European Conference on Biodiversity and Climate Change – Science, Practice & Policy", held on 12 & 13 April 2011 in Bonn, Germany, was organized by the German Federal Agency for Nature Conservation (BfN) in co-operation with the ENCA Interest Group on Climate Change and the University of Greifswald. A wide range of European experts convened to discuss the latest research findings in the field of biodiversity and climate change and to explore options of how to improve the dialogue between science, policy and practice. A major thread throughout the conference was the question of how scientific results can be better integrated into political decision making processes and implemented in practice.

Structure of the conference

The two day event comprised five sessions with presentations and time for questions and discussion, a poster session and a final panel discussion.

The first conference day began with two opening addresses by Beate Jessel, President of the German Federal Agency for Nature Conservation (BfN) and Nicholas Macgregor, chair of the ENCA Interest Group on Climate Change, who warmly welcomed the participants and provided an overview of the scope and background of the conference. In the following keynote presentation Karin Zaunberger, European Commission, gave an overview of ongoing policies and policy development on EU level with a view on how the biodiversity-climate link is recognised and thoughts on how the potential for multiple benefits could be better harnessed. During the first conference session speeches focused on impacts of climate change on different levels of biological diversity. Illustrated by examples from montane, marine and (sub)arctic ecosystems results from long term data set analysis and species distribution modelling were presented. The subject of the second session was adapting nature conservation policies, strategies and measures to climate change. Talks of this session focussed, amongst others, on ecological networks and protected areas and included conceptual questions such as rethinking the concept of "nativeness". The evening programme comprised a poster session and a special session on forecasting climate change impacts during which in-depth information on computer applications and modelling was provided.

The second conference day started with a session on integrated and ecosystem-based approaches to climate change adaptation and mitigation. In recognition of the global dimension of the climate challenge, the first four presentations focused on emerging international topics including options for greening REDD+ and the advantages of maps in exploring opportunities and risks for carbon and co-benefits in climate change mitigation planning. The last two presentations shared experiences from two European-based initiatives which are putting ecosystem-based approaches to adaptation and/or mitigation into practice. The last session was dedicated to socio-economic aspects with speakers presenting results from valuation studies on climate-relevant ecosystems such as forests and peatlands. The conference ended with a lively panel discussion (chaired by Prof. Dr. Beate Jessel, BfN; panelists: Nicholas Macgregor, Natural England; Prof. Josef Settele, UFZ Leipzig; Jaime Webbe, CBD Secretariat; Karin Zaunberger, European Commission) on possibilities for enhancing the science-policy interface as well as setting priorities for research and conservation action on the international, European, national and local level.

This issue

This BfN-Script gives an overview on the discussed issues and the major outcomes of the conference. Following the introductory part, these proceedings are complemented by a set of conclusions and recommendations based on information presented in talks and posters during the conference and in the final panel discussion elaborated by the ENCA Climate Change Group during a follow-up workshop to the conference. The core of this publication form the abstracts of oral and poster presentations which the majority of speakers and presenters of posters have kindly contributed to these proceedings. Most authors have included their contact details as well as key literature and useful web pages that allow the interested reader to further deepen his knowledge in the specific field. The slides of most presentations as well as an online version of this report can be downloaded from the conference documentation website at http://www.bfn.de/0103_conferenzce-biodiversity.html.

Conclusions and recommendations elaborated by the elaborated by the ENCA Climate Change Group

In April 2011, the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz), in collaboration with the ENCA Climate Change Group and the University of Greifswald, held an international conference on biodiversity and climate change. The aim of the event was to share knowledge and experiences among European scientists, conservation practitioners and policymakers, to improve both the integration of research outputs into practical conservation projects and the identification of further research needs. The event brought together over 200 participants from 22 European and four non-European countries.

Talks and posters at the conference covered a wide range of topics, including impacts research, vulnerability assessment, adaptation strategies, ecological networks and ecosystem services; across a wide range of biogeographic regions and ecosystems in Europe. The conference also covered some aspects of climate change mitigation and international topics.

Based on information presented in talks and posters during the conference and in the final panel discussion, the ENCA Climate Change Group has agreed the following conclusions and recommendations. These cover three broad topics: communication and sharing information; implementing adaptation; and further research priorities. Some of these conclusions will form the basis for future work of the group.

Improving the exchange of information between and among scientists and policy makers

Although the science-policy interface has been improved in recent years, there are still deficits which should be overcome by taking into account the following points:

a) Scientists working at the interface of biodiversity and climate change need to be aware of the political dimension of their findings. In order to provide adequate input for informed policy decisions the interdisciplinary exchange between natural scientists and scholars working in the humanities and social sciences needs to be improved.

b) Scientists should try to improve the communication to decision makers of issues such as:

- Possible synergies as well as possible trade-offs between different ecosystem services
- Possible tipping points and thresholds of ecosystems and the related implications for on the benefits they provide
- How to interpret uncertainty in research results
- The valuation of ecosystem services, particularly cultural services and non-use values of biodiversity

c) The way of communicating scientific findings to decision makers could be enhanced through:

- Communicating scientific findings in a concise but precise way that focuses on key conclusions without compromising on the correctness of the information.
- Good practice examples of good conservation, to demonstrate what adaptation for the natural environment means in practice.
- Improved outreach and communication of the findings as an integral part of all research projects
- More conferences and other events that bring together scientists from across the range of relevant disciplines and policy makers, with a focus on communicating information in a non-technical way

d) Communication is a two-way process. Vice versa, decision makers should be more receptive to new scientific findings and help identify further research needs.

e) At an international level, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), as a newly established body to support the science-policy interface in the field of biodiversity, can learn from the experiences of the Intergovernmental Panel on Climate Change (IPCC). IPBES should deal with the topic of biodiversity and climate change in an integrated manner.

f) In order to improve the scientific basis in the field of biodiversity and climate change the storage, sharing of and multiple use of existing data through established platforms etc. (e.g. the Global Biodiversity Information Facility) should be enhanced.

Implementing research findings and developing adaptation strategies

a) Implementation could be improved by:

- Making conservation research more interdisciplinary and having better links between natural and social scientists
- Better involvement of civil society and local communities from the outset
- Identification and communication of case studies to provide good examples of adaptation in action. Adaptation principles and concepts such as resilience and adaptive management are now reasonably well established; good examples of these concepts being applied in a rigorous way on the ground are still quite rare.

b) There is an increasing need to consider larger scale approaches, for example:

- Conservation of whole landscapes/catchments
- Consideration of large scale processes such as hydrology
- Better understanding of the relative importance of protected areas versus sustainable use of the intervening matrix
- Best practice examples and guidelines on the design and management of ecological networks, sharing ideas across the many countries that are now considering or establishing them

- Green infrastructure, as a concept comprising a variety of well established conservation measures, as well as general land-use issues in the wider landscape have to be seen in an integrated, trans-boundary context
- An increased need for cross-border cooperation

c) It appears likely that some conservation objectives might need to be reappraised, for example:

- the need to consider when and how to accept change (but the likely continuing importance of current important areas even if ecosystems change)
- accepting species not previously present in an area and possibly changing management to accommodate them
- assessing conservation value of an area if current high priority species move
- considering whether to accept translocation of species from countries where they can no longer survive

d) There is a need to consider economic aspects and to integrate conservation with other sectors and with other land uses such as agriculture

e) Limited conservation resources and increased pressures are likely to require careful prioritisation of objectives and where effort is focused

Some research priorities

a) Better understanding is needed of the variety of factors that influence individual species responses and ability to adjust to climate change, including physiological thresholds, the effects of predator, competitor and prey species, the role of different habitat features in facilitating or hampering adaptation, and the role of genetic diversity and potential for in situ adaptation in the evolutionary sense

b) Long term monitoring of changes needs to be continued and expanded. There is growing evidence that without it changes will not be detected or interpreted appropriately

c) The role of different habitat features in ecological networks – the relative importance of connectivity vs. habitat quality for different species; the balance of protected vs. areas in which conservation is integrated into other land uses

d) The need to try out some different management approaches (such as altering level of habitat heterogeneity and establishing a wider range of microhabitat) and monitor the effects so we're better prepared if the time comes when new approaches are needed

e) Better understanding and mapping of ecosystem services to inform better spatial planning and location of green infrastructure

f) Improved understanding of the synergies between biodiversity conservation and adaptation and mitigation benefits for people

1 Abstracts of oral presentations

1.1 Opening addresses

Research on biodiversity and climate change – a cross-sectoral task within the scope of BfN's science-based policy advice

BEATE JESSEL

German Federal Agency for Nature Conservation (BfN)

Dear conference participants, scientists, practitioners and policy-makers from all over Europe, it is my pleasure to welcome you to the European Conference on Biodiversity and Climate Change – Science, Policy and Practice 2011 in Bonn.

1 Biodiversity and climate change

Biodiversity loss and climate change are among the most pressing challenges of our times, and are strongly interconnected. Not only will climate change directly affect biodiversity but mitigation and adaptation measures taken by society already have and most probably will also in future have significant effects, both positive and negative, on biodiversity. Nature conservation is facing two main challenges at the moment. One is**,** to adopt itself to climate change, which concerns nature conservation policies, strategies and concrete measures. At the same time, there is the pressing need to communicate the multiple benefits of integrated and ecosystem-based approaches to climate change adaptation and mitigation, in order to better gain synergies with other sectors and a broad valuation of biodiversity.

Over the past years, conservation scientists have been gathering a vast amount of evidence on the complex interactions between climate change and biodiversity. However, the integration of this knowledge in the political decision making process and the implementations on the ground are still lagging behind.

Given the still improvable communication between nature conservation scientists and policy makers, the German Federal Agency for Nature Conservation and the European Network of Heads of Nature Conservation Agencies in co-operation with the University of Greifswald have invited to this conference to discuss the latest research findings in the field of biodiversity and climate change and to explore options of how to improve the dialogue between science, policy and practice.

I will now give you a brief overview of the broad spectrum of climate-related activities at our agency and its involvement at the European and international level.

2 The relevance of research for fulfilling BfN's responsibilities

The German Federal Agency for Nature Conservation - in the following referred to as BfN which is the German abbreviation - is the German Government's scientific authority with responsibility for national and international nature conservation in Germany.

BfN furthers its objectives by carrying out related scientific research. Scientific evidence is needed to provide the German government with advice for decisions on all aspects of national and international nature conservation, and to identify new areas where policy choices need to be made and to improve the implementation of nature conservation policies.

To support the scientific base BfN is in charge of some funding programmes: Under the framework of the German Environment Ministry's Environmental Research Plan, BfN plans, awards and supports research and development projects in nature conservation and ecology. We also supervise research and development projects. These are pilot projects which are supervised by research and which aim to put innovative nature conservation ideas into practice. BfN performs a key knowledge transfer function for nature conservation by preparing scientific knowledge and rendering it suitable for practical application.

3 BfN's research focus on climate change

Climate change with its direct and indirect impacts on biodiversity is considered as a cross-sectoral topic relevant to almost our entire agency.

In 2008, the Federal Environment Ministry committed part of the revenues from the sale of tradable emission certificates for biodiversity projects with climate relevance. Thereupon BfN launched more than 30 research and development projects covering the most relevant aspects from the German perspective. Project partners include more than 46 universities, research institutes and planning offices. The majority of these projects are completed now; only 6 of them are still running.

3.1 Spectrum of BfN's climate research

The BfN funded climate projects cover a broad spectrum of questions and approaches.

Six of our projects focus on mitigation. Some analyse the synergies and conflicts between the expansion of renewable energy such as biomass or hydropower and nature conservation objectives. There are also projects on the monetarization of the carbon sequestration potential of selected ecosystems (primarily peatlands) and a project on REDD which will be presented tomorrow. Since the dramatic accident at Fukushima the pressure to increase the amount of renewable energy in Germany has risen enormously. This will have a considerable impact on nature conservation as well as on the valuation of different spatial demands.

The majority of the BfN funded research projects focus on adaptation. One group of these projects looks into the impacts of climate change and related human response activities on biodiversity in order to develop scientific based proposals for adapting nature conservation policies, strategies and measures to climate change, so they remain within the nature conservation sector itself. Other projects of this category explore options for maximizing conservation co-benefits within the scope of climate adaptation measures of other sectors for example silviculture or transport. Furthermore, BfN tried to increase knowledge on

integrated and ecosystem-based approaches to climate change adaptation and mitigation and also on ecosystem services. For example, one project analysed the potential benefits of floodplain restoration for adaptation, mitigation and biodiversity conservation in order to identify priority areas for restoration projects. Other projects focus on the options and needs of advancing regulatory instruments such as landscape planning and conservation legislation. We also have projects running on ethical aspects because dealing with climate change is also a question of dealing with values. Finally, we have several implementation-focused and practice-oriented projects ongoing. Many of them are located in biosphere reserves, model-regions for a sustainable way of life.

A complete list of all ongoing research projects including links to further information and relevant publications is available in German on the BfN Homepage (http://www.bfn.de/0307_klima_forschung.html).

During the course of this conference six of the above mentioned projects will be presented. Now I will just introduce four additional examples to you, illustrating the broad spectrum of our activities in relation to climate change.

3.2 Project example 1: Germany‘s protected areas under climate change- risks and policy options[1]

Despite the fact that we promote an integrated nature conservation approach protected areas play a crucial role for biodiversity. But how will they be – predictably – affected by climate change? The research & development project „Germany‘s protected areas under climate change – risks and policy options“ provides climate projections until the year 2055 for more than 4000 protected areas. All projections are free for download from the web (http://www.pik-potsdam.de/~wrobel/sg-klima-3/nav_bl.html).

Whereas the temperature trends are positive all over the country, projections of precipitation vary considerably in both directions. Therefore, the climatic water balance, representing the difference between precipitation and potential evaporation, is an interesting integral parameter. All over Germany, projections for protected areas show a trend of an aggravating climatic water balance in summer, that is, during the growing season.

The results of the climate models and the ecohydrological models are consistent with those of the bioclimatic niche models. The niche models show that for example communities of wetlands (swamps, fens, and bogs) belong to those vegetation types, which are strongly affected by climate change.

Adaptation of protected area management shall factor in the risks for conservation targets accordingly. However, the management of protected areas is in need of a more fundamental shift: The administrational infrastructure for nature conservation needs to be strengthened, and management planning should become more systematic and adaptive. Furthermore, protected area managers should be enabled to competently deal with evidence about climate change impacts as well as with decisions under uncertainty. One existing concept, the CBD‘s Ecosystem Approach comprises a set of rather general principles which might provide a general framework for planning processes which still need to be further detailed for

[1] For further information on the project, see pp. 67-68.

application and seem particularly useful for adaptation of nature conservation to climate change in the context of large scale protected areas.

By factoring in climate change scenarios and vulnerability assessments and by defragmenting the landscape conservation targets are strengthened.

3.3 Project example 2: Still warmer, still drier? Urban nature and green space structures in the context of climate change[2]

The project "Still warmer, still drier? Urban nature and green spaces in the context of climate change" focused on the following questions:

(1) Do urban green spaces contribute to adapting urban areas to climate change?

(2) And how can nature conservation and green space planning objectives be better implemented in urban development in the light of climate change?

The recommendations elaborated in the project deal with the design of urban green spaces systems and with the implementation of green space planning measures for adapting to climate change.

As a basis 57 urban vegetation structure types were distinguished as suitable homogeneous units, defined in terms of their vegetation structure. Planning recommendations were drawn up for the design of urban green space systems. Profiles were prepared for the urban vegetation structure types, supplying important information for the planning and management of urban green spaces in the course of adaptation to the repercussions of climate change in urban areas. Urban land-use scenarios make it possible to simulate potential negative effects of increased urban density or the positive effects of more extensive green spaces.

One example scenario is the designation of new residential areas on lawns in a neighbourhood park. The modelling shows that such a plan, when implemented, would lead to a temperature increase of 0.5 K to 1.0 K.

The following conclusions can be drawn:

- Green spaces have positive effects on urban climate.
- Large and coherent areas have a stronger cooling effect compared to small areas.
- The cooling effects within green spaces differ depending on vegetation structure.
- The higher the green volume density of a green space, the stronger is the cooling effect.
- Cooling effects of urban vegetation structure types differ between day and night.
- Built-up areas have almost no cooling effect.

The existing and established regional and urban land-use planning, as well as landscape planning tools should be exploited in preparing and implementing green space planning adaptation measures.

[2] For further information on the project, please refer to the following website: http://www.bfn.de/0321_stadtnatur.html

3.4 Project example 3: Planning and management strategies of nature conservation[3]

The project "Planning and management strategies of nature conservation in the light of climate change" focuses on consequences of climate change for instruments of nature conservation. After providing an overview of the consequences of climate change and its impacts the project discusses the need to re-define existing or to set up new guidelines, aims, strategies, instruments and measures of nature conservation. It also examines the suitability of the ecosystem approach, adaptive management, risk management and vulnerability to cope with consequences of climate change for nature conservation. On this basis (new) requirements for landscape planning to address climate change are discussed as well as possibilities to implement them. What are the main results of the project?

The existing legal instruments in Germany deliver a sufficient basis for nature conservation to cope with climate change. Current aims, strategies and measures of nature conservation remain effective and applicable in many cases, but nonetheless a shift in priority and the consideration of new topics are necessary – for example climate protection through the maintenance of natural carbon sinks, the improvement of urban climate and human health through green spaces, preservation of abiotic resources like water and a more thorough consideration of scenery and recreation. Adaptive management seems appropriate for small conservation sites and situations with low complexity in comparison with the ecosystem approach which is more appropriate for large scale - and complex settings.

Nonetheless the idea of adaptive and flexible planning processes becomes more important in the context of climate change. To help landscape planners in their practical daily work a checklist shows many existing possibilities to address climate change and its impacts within each working step of landscape planning.

3.5 Project example 4: Ethical arguments and nature conservation[4]

Nature Conservation is always based on societal agreements. So ethics play a crucial role in this field. BfN fosters an ongoing dialogue concerning this topic.

The National Biodiversity Strategy (NBS) is presently the most important strategy for the conservation of biodiversity in Germany. Ethical arguments are mentioned here explicitly, although in a short and very condensed form. However, in an implicit way current as well as traditional arguments for the conservation of nature are made use of throughout the NBS, namely ecological, economic and sociocultural ones.

The project's report[5] is dealing with the ethical foundations of the national biodiversity strategy: It presents a deep analysis and transparent restructuring of the ethical arguments included in the NBS,

[3] For further information on the project, see pp. 78-79.

[4] For further information on the project, see pp. 83-84.

restructuring the arguments in a broad and solid ethical foundation that leaves old-fashioned discussions like "ecological versus economical arguments" behind but suggests three types of ethical arguments relevant for nature conservation: Prudence, justice and good life.

Arguments of the prudence-type focus on the fact that we should conserve biodiversity because it is in our own interest. Economic as well as ecological arguments both belong to this category. In present debates concerning nature conservation these arguments prevail. Arguments of justice refer to our obligation to protect biodiversity and use it sustainably. We have responsibilities for today's society but also for future generations. Arguments of justice are strong arguments because of their binding character. And last but not least arguments for a good life deal with the fact that we should conserve our nature because we love and value it: biodiversity and nature are part of a satisfying human life. Arguments of this type are often well-understood by many people because of their emotional character but considered to be not sufficient by themselves.

4 BfN's international involvement

Besides our climate research focus on questions of national relevance, it is our special concern to contribute to and benefit from discussions at the European and international level.

On the initiative of BfN the Network of Heads of European Nature Conservation Agencies also called "ENCA network" – was founded in 2007. The aim of this informal network consisting of agencies from all over Europe is to strengthen nature conservation in Europe, by enhancing exchange and cooperation between its members. On matters of mutual concern so called interest groups have been established to support the networks' goals.

I am very pleased that ENCA is co-organizer of this conference and has been heavily involved, namely through the interest group on climate change. It will be my pleasure to hand over to Nick Macgregor, head of this ENCA interest group, who will present ENCA's objectives and activities in more details right after my talk.

At the international level, BfN is actively involved in various scientific networks and supports the German government in meeting the country's obligations under international agreements, including the Convention on Biological Diversity. We also work on the integration of biodiversity conservation issues into the United Nations Framework Convention on Climate Change and its Kyoto Protocol with a special focus on REDD and biodiversity co-benefits.

5 Scope of the conference

Coming to an end of my presentation, let me close with a brief overview of the conference and its goals. I am very happy that more than 200 participants from 26 countries have found their way to this two day conference on Biodiversity and Climate change. More than twenty experts from all over Europe will

[5] Eser, U., Neureuther, A. & Müller, A. (2011): Klugheit, Glück, Gerechtigkeit. Ethische Argumentationslinien in der Nationalen Strategie zur biologischen Vielfalt. Naturschutz und Biologische Vielfalt. Heft 107. Bonn - Bad Godesberg.

present the latest results in the field of biodiversity and climate change. The results will be discussed intensively with special focus on the questions of how they can be translated into politics and applied in practice. I specially invite you to have a look at the posters downstairs that were contributed by working groups from all over Europe. Another highlight of the conference will be tomorrow's panel discussion on "priorities for research and conservation action and opportunities for enhanced cooperation" with representatives from science and policy.

The major goals of the conference are:

- Improving the dialogue between science, policy and practice; and
- Strengthening Europe-wide cooperation

in order to protect our natural heritage for the sake of current and future generations. Neither biodiversity nor climate change stop at national borders. Effective conservation in times of climate change can only be achieved by working together internationally!

Helping Europe's wildlife and ecosystems adapt to climate change: research and conservation challenges

NICHOLAS MACGREGOR

Chair, ENCA Climate Change Group

Climate change is already affecting Europe's wildlife and ecosystems. Potentially severe changes are possible in the future, given that recent evidence suggests that scenarios of climate change previously considered to be extreme are now well within the bounds of possibility this century. To cope with future changes, new adaptation strategies for conservation are likely to be required.

This presents challenges for conservation managers, who will need to incorporate adaptation into their conservation objectives and management decisions and to consider whether some existing conservation practices might need to be modified in the future. There are also challenges for ecological researchers, who need to renew their efforts to understand complex natural systems under increasingly dynamic and variable conditions, and to translate this information into clear advice for conservation managers. Climate change also increases the need for a cross-European approach to nature conservation. The ENCA Climate Change Group, whose members come from government conservation agencies from a range of European countries, is working to try to share knowledge and promote a collaborative approach.

This talk briefly outlined the current work of the ENCA Climate Change Group, and posed a range of challenging and important questions relating to both the science and practice of conservation in a changing climate. These questions touched on topics such as:

- The state of our current scientific knowledge about the impacts of climate change on species and ecosystems, and about ecosystem services;
- The challenge of understanding, predicting and responding to major shifts in ecosystem structure and function;
- Understanding when and how we might need to accept changes, and setting conservation objectives that are sufficiently flexible without compromising overall goals;
- How the concept of 'resilience' might be applied in conservation;
- Assessing vulnerability, and how effort might be prioritised as a result;
- Considering new and more radical approaches to conservation;
- The influence of changes in other sectors, particularly agriculture.

This was intended to help set the scene for the conference and provide a framework of questions to which subsequent talks would start to provide some answers.

1.2 Keynote presentation

Biodiversity and climate change: an overview of EU policies and some challenges and opportunities

KARIN ZAUNBERGER

European Commission

To set the scene the presentation lays out the biodiversity-climate change link demonstrating that it is impossible to address biodiversity loss without tackling climate change and that it is equally impossible to address climate change without tackling biodiversity loss and ecosystem services.[1] Marine and terrestrial ecosystems currently absorb roughly half of anthropogenic CO_2 emissions.[2] This means for stabilising the climate it is necessary to dramatically reduce our emissions, as well as to maintain, enhance and restore the natural carbon sinks. The updated burning embers diagram[3] shows the reasons for concern – *inter alia* - for unique systems such as coral reefs or tropical forests. It becomes clear that a global temperature increase of 2°C may already be too much to guarantee the long-term viability of these unique systems.

If concentrations of carbon dioxide remain at today's level, many coral dominated reefs will survive although there will be a compelling need to increase their protection from local factors such as deteriorating coastal water quality and overfishing. If carbon dioxide concentrations continue to rise as expected, reefs will become less dominated by corals and increasingly dominated by seaweeds. If carbon dioxide levels continue to rise as we burn fossil fuels, coral reefs will disappear and will be replaced by crumbling mounds of eroding coral skeletons, which are no longer capable of fulfilling their protective function. The consequences of this loss for coastlines and islands risk will be catastrophic. In concert with such a progression it can be expected that much of the enormous and largely unexplored biodiversity of coral reefs will disappear. This will almost certainly have major impacts on the tourist potential of the coral reefs as well as their ability to support fisheries.

Ecosystems not only contribute to mitigation, but also play an important role in helping us to adapt to the impacts of climate change. Strong and resilient ecosystems are our life insurance against climate change, providing a 'natural fix' for mitigating and adapting to its consequences.[4] Ecosystem-based approaches to climate change adaptation and mitigation are ready for use and bring multiple benefits at a comparatively low cost. Investing in nature and green infrastructure makes economic sense and is vital to control climate

[1] Message from Athens http://ec.europa.eu/environment/nature/info/pubs/docs/message_athens.pdf

[2] Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks; Canadell at al; 2007 http://www.pnas.org/content/104/47/18866.abstract

[3] Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) "reasons for concern"; Smith et al; 2009 http://www.pnas.org/content/early/2009/02/25/0812355106

[4] COM(2010)4 Options for an EU Vision and target for biodiversity beyond 2010 http://ec.europa.eu/environment/nature/biodiversity/policy/pdf/communication_2010_0004.pdf

change. This has been recognised in a growing number of reports[5], in CBD COP decisions[6] and consecutive Environment Council Conclusions[7] which recommend the development and use of ecosystem based approaches to climate change adaptation and mitigation.

In the second part of the presentation an overview is given on ongoing policies and policy development on EU level with a view on how the biodiversity-climate link is recognised and thoughts on how the potential for multiple benefits could be better harnessed.

The upcoming EU Biodiversity Strategy up to 2020[8] shall follow up on the outcomes of CBD COP 10. While nature conservation through the implementation of the Nature Directives remains a main pillar, a strong focus is put on ecosystem services and the need and potential of restoration and green infrastructure are also highlighted. Work is underway towards a dedicated initiative on Green Infrastructure, which can deliver multiple benefits and may become a major tool for integration. Partnerships play an important role, such as the planned scheme for promoting the conservation and the sustainable use of "Biodiversity and Ecosystem Services in European Overseas Entities", known as BEST[9].

The presentation briefly touched on other policies relevant to the biodiversity-climate change link: Climate Change policies[10] involving the fields of renewable energy, low carbon economy and adaptation; the ongoing reforms of the Common Agricultural Policy[11] – greening of the CAP -and of the Common Fisheries Policy, where the ecosystem approach is being addressed; the regional and cohesion policy[12],

[5] For example:

- Convenient Solutions to an Inconvenient Truth, Environment Department World Bank http://siteresources.worldbank.org/ENVIRONMENT/Resources/ESW_EcosystemBasedApp.pdf
- Discussion Paper – Towards a Strategy on Climate Change, Ecosystem Services and Biodiversity http://ec.europa.eu/environment/nature/pdf/discussion_paper_climate_change.pdf
- Workshop Report Working with Nature to tackle Climate Change http://www.bfn.de/fileadmin/MDB/documents/service/Skript264.pdf
- CBD Technical Series N° 41, Connecting Biodiversity and Climate Change Mitigation and Adaptation http://www.cbd.int/doc/publications/cbd-ts-41-en.pdf
- The Natural Fix, UNEP http://www.unep.org/pdf/BioseqRRA_scr.pdf

[6] CBD COPX 33 on Biodiversity and Climate Change CBD COPX 31 on Protected Areas http://www.cbd.int/cop10/doc/

[7] ENV Council Conclusions of 22 September 2009 http://register.consilium.europa.eu/pdf/en/09/st17/st17785.en09.pdf ,

ENV Council Conclusions of 14 October 2010 http://register.consilium.europa.eu/pdf/en/10/st14/st14975.en10.pdf

ENV Council Conclusions of 14 March 2011 http://www.consilium.europa.eu/uedocs/cmsUpload/st07755.en11.pdf

[8] Note that at the time when the presentation was given (12 April 2011) the strategy was not yet adopted, but still work in progress.

[9] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/241&format=HTML&aged=0&language=EN&gui Langua ge=en

[10] See http://ec.europa.eu/clima/news/index_en.htm

[11] See http://ec.europa.eu/dgs/agriculture/index_en.htm

[12] See http://ec.europa.eu/dgs/regional_policy/index_en.htm

which includes possibilities for green infrastructure which remain unused. Efforts are underway to "invest better" and to provide Guidelines how to use regional funds for biodiversity.

The preparations for the next financial period (2014-2020) are already ongoing. This can be an opportunity to increase integration and to phase out environmental harmful subsidies.

It emerges that collaboration and synergy are key. In this respect the "Rio Conventions' Ecosystems and Climate Change Pavilion"[13] a joint outreach activity of the three Rio Conventions[14] and a number of core partners including the European Commission, Lifeweb, UNEP, UNDP and many more, which seek to harness synergy and promote collaboration is a very timely and useful initiative.

[13] See http://ecosystemspavilion.org

[14] Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC) and United Nations Convention to Combat Desertification (UNCCD).

1.3 Session I: Impacts of climate change on biodiversity

Assessing the fate of montane biodiversity in Europe under Climate Change- a novel approach using species distribution modeling and population genetics

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Considerable efforts have been made to predict effects of Global Climate Change (GCC) on biodiversity (e.g., Thomas et al. 2004). However, no study has yet examined how intraspecific genetic diversity will be affected, despite the fact that this level of diversity is a crucial factor for the long-term survival of populations and species. Especially under current predictions of rapidly changing environmental conditions, species persistence will critically depend on the amount of existing genetic diversity, which provides the raw material for genetic adaptation processes (Davis & Shaw 2001). We thus tested the usefulness of a novel approach, which combines species distribution modeling and assessment of genetic diversity in order to predict losses of genetic variability under climate change.

We focused on montane communities due to their high vulnerability to GCC, since many species are adapted to low-temperature environments, and populations are often restricted to isolated habitat patches with no or limited dispersal amongst them (Pauls et al. 2006). This geographical isolation furthermore leads to strong genetic substructuring, which facilitates modeling the loss of regional genotypes.

To test if GCC will potentially lead to a significant range-wide loss of genetic biodiversity, we used a species distribution modeling (SDM) approach. We projected the current as well as the future range (year 2080) of nine montane, aquatic insects (orders Plecoptera, Trichoptera) following two commonly used greenhouse gas emission scenarios (A2a, "business as usual" scenario; B2a, "reduced CO_2 emissions" scenario; IPCC 2007), three climate models (CSIRO, HadCM3, CCCMA), and six algorithms implemented in the Biomod package version 1.1.5 in R (Thuiller et al. 2009). Genetic loss was calculated by comparing future range loss inferred from SDM with rangewide data on mitochondrial sequence data from all nine species considered.

The results show that the projected loss of genetic variability greatly exceeds the biodiversity loss from the consideration of entire morphospecies. While one or three of nine morphospecies are projected to become extinct by 2080 following the B2a and A2a scenario, respectively, 233 and 291 of 345 haplotypes (68% - 84%) are projected to face extinction under GCC. In addition, we found a severe loss of cryptic evolutionary lineages, which face extinction under both emission scenarios. These results suggest, that currently predicted GCC effects on biodiversity might be underestimated without consideration of the intraspecific scale of biological variability.

In order to test the suitability of this approach on a local scale, we combined the assessment of fine scale genetic substructuring and gene flow with SDMs of the submontane Wood Cranesbill (*Geranium sylvaticum*) in the Taunus mountain range in Germany. Genetic variation in 15 populations over the entire

distribution range was measured using AFLP analysis. The results allowed to identify populations for prioritization in conservation strategies under GCC. Four high-altitude populations showed high values of genetic diversity with strong gene flow among them and highest occurrence probabilities under two GCC scenarios.

In addition to the above-mentioned approaches, we are currently using population genetics for several other GCC related research topics, including the detection of invasive species, measurements of genetic adaptation potential, and assessments of fine-scale dispersal and gene-flow patterns in aquatic invertebrates.

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Long term research of the Dogger Bank Epibenthos (North Sea): loss of biodiversity and changes in climate

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Since 1991, we are conducting a long term study on a yearly basis at a research area at the Dogger Bank, containing 37 locations. Work is carried out with the aid of RV "Senckenberg". The sampling sites cover an area of approximately 17.000 km² and are located at the economic zones of Great Britain, the Netherlands and Germany. Until today, 17 summer cruises (in-between July 15 and August 15) and two successful winter cruises (January/February) were performed. On each cruise, a 2m beam trawl is used to sample the epifauna at the 37 stations. In addition, temperature and salinity, as well as current strength and –direction of the water body are being sampled with the aid of different probes.

In February 2010, we had the first successful Dogger Bank winter cruise with RV "Heincke", to study the species composition under the influence of temperatures as cold as possible in order to contrast the results of the summer cruises. In February 2011, we conducted another winter cruise to support the results of the winter cruise one year before, which have already been presented at the "Symposium of the Marine Environment 2010" of the Federal Maritime and Hydrographic Agency in Hamburg.

Our long term dataset is analyzed and interpreted in the framework of a project of the Biodiversity and Climate Research Centre (BiK-F) in Frankfurt am Main. The epifaunal community structure, which has been sampled quantitatively on all cruises, was correlated with a comprehensive long term temperature dataset to explain a considerable decrease in biodiversity and species richness during the research period.

Nevertheless, a consortium of British power concerns is planning to build Europe's largest offshore-windpark at the British economic zone of the Dogger Bank. Potential impacts of the building activities on the epifauna could be studied by a set of additional, specific research cruises and our long term dataset as a basic reference.

A loss of biodiversity at the Dogger Bank as a potential stepping stone for the recruitment of new organisms for the surrounding marine areas can have additional consequences for the fishing industry of the neighbouring countries, which should not be underestimated.

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Biodiversity in the (sub)arctic under different climate change scenarios

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The threat of a further changing climate has been recognized as one of the main drivers behind (future) extinctions. Especially the arctic region is expected to be affected. Evidence shows that species respond to climate change by adjusting their geographic distributions. The large expected impacts of future climate change in the arctic region make species in areas like the Barents Region particularly vulnerable. In response of expected climate change and subsequent effects on biodiversity, we use species distribution modelling to assess the capacity of existing protected areas in the Barents region to safeguard their current biodiversity under different climate change scenarios (CGCM2, developed by the 'Canadian Centre for Climate Modelling and Analysis', and HadCM3 developed by the Hadley Centre, both under emission scenarios A2 and B2 [freely available at WorldClim http://www.worldclim.org/futdown.htm]) in the year 2080.

Currently, the spatial distributions of a range of mammals, reptiles, amphibians and birds have been modelled for current and future situations, and we are continuing with other taxa. We were able to conclude that the climatic conditions are expected to improve in the Barents Region for many species in the future. More warm and wetter conditions allow a considerable number of species to expand their distribution range. However, various species (especially habitat specialists) are expected to contract their range over time. Furthermore a number of new species are predicted to be able to invade the region, altering community composition and biotic interactions in ways difficult to anticipate.

An example of a species that is predicted to expand its range in future is the West-European hedgehog (*Erinaceus europaeus*), a common, widespread insectivorous mammal. It is currently mainly occurring in the more southern, relatively warmer parts of the Barents region. As a hibernating species, it is bound by cold climates. With the expected warming of the Barents region it is predicted that the hedgehog will be able to expand northwards. A species like the whiskered bat (*Myotis mystacinus*) is expected to expand its range by such an extent northwards, that it is predicted to be able to reach the Barents Region by 2080. The species is currently occurring in the southern parts of Norway, Sweden, Finland and North-western Russia, and absent from the Barents region. As many bats, the whiskered bat is limited in its distribution by cold temperatures. Consequently, it is not surprising that with a warming climate it is predicted to be able to find its way up to the Barents region in the future.

The Norway lemming (*Lemmus lemmus*) on the other hand, is expected to decrease its range in future. The species is currently occurring in large parts of Norway, Sweden, Finland and parts of North-western Russia. It is endemic to the region and mainly inhabits alpine and subarctic habitats. However, it is expected that these habitat types will cover less area in the Barents region in the future due to climate change. It is therefore not surprising that the distribution range of the Norway lemming is expected to decrease. The Norway lemming is currently already classified as 'least concern' by the IUCN Red List of Threatened Species (http://www.iucnredlist.org/apps/redlist/details/11481/0). Moreover, the species is likely going to face declines due to climate change as well, which not only poses a threat to the species

itself, but may also increase pressure upon other species that heavily prey upon Norway lemming, like the arctic fox (*Alopex lagopus*).

For further information, please refer to the following website:

http://www.emg.umu.se/english/research/research-projects/the-capacity-of-protected-areas-in-the-barents-region-to-conserve-biodiversity-threatened-by-climate-change/

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The Global Biodiversity Information Facility (GBIF): Biodiversity data, data standards, access and tools to forecast climate change impacts on biodiversity

NICK KING

Global Biodiversity Information Facility

In many regions we are still unable to monitor and quantify the status of biodiversity due to a dearth of species-occurrence data at relevant scales and compatible formats and a lack of infrastructure and institutional cooperation to enable data discovery, access and interoperability.

A partial solution to the problem of data availability and interoperability is agreement on a global mechanism to facilitate sharing of existing and future biodiversity data both within and between countries. The inter-governmental Global Biodiversity Information Facility (GBIF); through GBIF, institutions and countries can publish their databases online to common exchange standards, and thus join a growing global network of distributed yet shared biodiversity datasets. For many research communities, GBIF has been instrumental in enabling link-up of their distributed information resources, and as of February 2011, some 270 million primary biodiversity data records are accessible via the GBIF network.

Access to such data and associated metadata is vital to a diverse range of scientific communities and national agencies worldwide across areas as diverse as conservation, agriculture, forestry, marine resources, and invasive alien species. Examples were given of how enhancing discovery and access to biodiversity data, and interoperability with for example climate change models, enables enriched analyses in support of national and international policies.

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1.4 Session II: Adapting nature conservation policies, strategies and measures to climate change

Climate change and the Natura 2000 network: assessments of species and habitat vulnerability

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Understanding the vulnerability of species and habitats to climate change is vital in the development of adaptation strategies for biodiversity. Since resources for nature conservation (including the protection of species and habitats from climate change) are limited, it is necessary to identify and prioritise those that are most vulnerable as a focus for adaptation action. Vulnerability assessments can inform decisions on these priorities.

The European Commission project Biodiversity and climate change in relation to the Natura 2000 network established a semi-quantitative methodology for assessing the vulnerability of species to climate change. Building on this methodology, the European Topic Centre on Air and Climate Change undertook the study "A methodology for assessing the vulnerability to climate change of habitats in the Natura 2000 network" to further develop it for assessing habitat vulnerability.

The methodology allows the vulnerability of Natura 2000 species and habitats to be assessed with relative ease. However, its use is restricted by available data on the sensitivity of characteristic species and the adaptive capacity of corresponding habitats. With improvements in data availability and reliability, the resulting vulnerability assessments could provide a valuable indication of where conservation/adaptation action is most needed across the Natura 2000 network.

Adaptive management of climate-induced changes of habitat diversity in protected areas

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Within the transnational project HABIT-CHANGE (Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas) impacts of climate change on habitat diversity within protected areas in Central and Eastern Europe are under investigation.

The European network of protected sites is challenged by anthropogenic actions and climate change. Nature conservation agencies have to cope with modifications of habitat composition induced by climate change. This also affects conservation targets. There is a lack of knowledge regarding regional climate change, its impact on habitats and the need for adapting management. At site-level, precipitation might de- or increase and shift its seasonality, leading to different preconditions for the remaining natural habitats. The direction of future changes and how they are affected by management measures are unclear. Likewise indicators and monitoring techniques applied for the local scale are missing.

HABIT-CHANGE does not only analyse the impacts of climate change on habitats but also focuses on the necessary changes of our habits in conservation management and land use in protected areas. It will provide tested recommendation and guidelines for climate proofing of protected areas on local, national and EU-level. Basic concepts for and first results of the evaluation and climate proofing of management plans are presented. Suitable indicators, modelling methods and monitoring concepts based on earth observation and field data are discussed.

Further Information

http://www.habit-change.eu

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Forest conservation in a changing climate: adjusting concepts and policies in Germany

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Keywords: forest conservation, forest policy, climate change, forest ecosystem, biodiversity

Climate change poses new challenges to biodiversity conservation in forests, the management of forest ecosystems and related policies. The R&D-project "Forests and Climate Change" aims at making recommendations for adapting nature conservation concepts and policies in central European forests to climate change, focussing on Germany. It consists of two sub-projects, one dealing with nature conservation objectives, strategies, and forest management, one dealing with forest conservation policy.

At the outset of the forest conservation strategies sub-project, the international scientific literature was reviewed regarding impacts of climate change on forest ecosystems and consequences for nature conservation (Milad et al. 2011). Key challenges in relation to area specific protection of species and habitats were identified. However, there were in part great uncertainties regarding forest ecosystems' reactions and adaptive capacities of tree species and forests which need to be addressed through additional research. Changing climatic conditions require that static concepts, objectives and reference systems such as 'native species composition' be reconsidered and further developed. In a second step, we conducted interviews with forest practitioners in four regions of Germany. In these interviews we posed the main question of whether projections and observations of climate change have already lead to adaptation measures in forest management and conservation and, if so, what these measures are. Interview regions differed in regard to their currently dominating tree species and assessed vulnerability (Umweltbundesamt 2005). Within and between the study regions, different forest ownership regimes were considered. The interviewees made reference to various forest adaptation measures e.g. increasing species diversity or reducing the proportion of high-risk tree species such as Picea abies. Increasing single tree stability through thinning measures as well as the reduction of rotation periods or earlier achievement of target diameters were also reported. In this regard, some interviewees considered only P. abies, whereas others also included additional species such as F. sylvatica or Quercus spp. Most interviewees preferred natural regeneration and also expected it to reduce silvicultural risks in a changing climate. When questioned about adaptation referring specifically to nature or species conservation in forests, most interviewees stated that no specific measures were intended at this point. However, there were initial considerations in this regard such as maintaining a high habitat diversity including refugial areas. Overall, conservation objectives differed according to the region, forest ownership regime and responsible person. We conclude that current forest management strategies cannot be easily equated with a distinct climate change adaptation strategy. Rather, our interviews conveyed the impression that management activities were a mixture of adaptation to climate change and independent strategies related to nature-orientated forestry or general risk reduction. Some of these strategies may be beneficial; others hold the potential to negatively affect nature conservation in forests. The latter is particularly true for the reduction of rotation periods for deciduous tree species. Hence, there is a need for developing a framework for adapting nature

conservation strategies in forests to climate change. This should include a graded set of well-founded recommendations, offering both possible and essential courses of action.

This leads to the second sub-project on forest conservation policies. In this sub-project, forest policy discourses on climate change have been analyzed firstly by reviewing over 70 press releases and other official statements and documents of forest and nature conservation policy makers as well as over 100 related articles in professional journals. Compared to the professional and scientific discourse, the political discourse is less complex and tends to be polarized. This is the case as the inherent uncertainty of climate change is partly instrumentalised such that information which is non-consistent with political beliefs and interests is masked. Forest as well as nature conservation policy stakeholders also tend to argue for well-known, previously developed agendas referring to climate change issues. Two major lines of argumentation ("storylines") can be distinguished: On the one hand, forests are seen mainly as a means of climate change mitigation; on the other hand, forests are seen mainly as threatened by climate change. The first of these arguments reaches the conclusion that forests should be utilized more intensively, so as to contribute to carbon sequestration through increased utilization of wood and to reduce risks by shortening rotation periods. The second line of argumentation stresses forests' function as carbon pools and the need for adaptation and risk reduction through the enhancement of forests' overall quality (increasing tree species diversity, using native tree species and natural regeneration in order to allow for evolutionary adaptation, increasing ecological connectivity). While the first storyline is mostly taken up by the forest sector, including the timber industry, the second storyline is mostly used by nature conservation actors to advocate their strategies. However, policy actors may use arguments from both storylines and the discourse is differentiated on a more operational and professional level of decision-making. When it comes to the question of how polarized political discourses are transformed into policy instruments, little change in response to the challenge of climate change seems to have occurred so far. Based on expert interviews and a workshop with experts of forest and nature conservation policies, it can be concluded that few amendments have been made in existing forest and conservation policy instruments such as financial support schemes or forest conversion programs. Climate change adaptation policy is at this time primarily a knowledge policy; that is, most resources are spent on research and knowledge transfer. This has also led to new approaches in 'soft' advisory services and training as well as forest planning, while leaving the 'hard' policy instruments (law, subsidies) largely untouched. This 'soft' response to climate change does clearly reflect the two approaches mentioned above: nature-oriented forest adaptation versus intensified management. In a similar manner, experts' recommendations for the amendment of forest policy instruments strongly depend on their ideological orientation: some prefer clear standards including effective regulative instruments; others strongly oppose any rigid measures and advocate liberal 'laissez faire' approaches.

In summary, there is both a great diversity of conceptual proposals for forest conservation strategies in a changing climate in the international scientific literature and a great attention to this issue in contemporary forest policy debates. On the other hand, when it comes to concrete policy instruments and the manner in which forest and conservation policy is 'brought on the ground', those intensive discourses do not seem to translate into genuinely new and innovative policy instruments. As shown in our interviews, they have also failed to lead to concrete adaptation strategies in current forest management yet. It is beyond the scope of this project to analyze fully this contrast and its implications for forest management or forest conservation policies. However, the intention in the final stage of the project is to

develop some concrete hints for how these four ‘different worlds’ − the academic and the political debate, the design of policy instruments, and the approach of practitioners towards dealing with climate change in their daily decision-making − can be brought together in a fruitful manner.

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CLIMIT - CLimate change impacts on Insects and their MITigation

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CLIMIT assesses the combined impacts of human-induced changes in climate and habitat (area, isolation, patch quality) on some of Europe's most specialised and threatened grassland insects that depend on ants (myrmecophiles), by studying their local adaptations, changing niches and different needs across a gradient of local climates from the Mediterranean to the North/ Baltic seas.

CLIMIT will compare the fates of species that have different relationships with ants under different scenarios of climate and land use change, as well as studying their potential to evolve adaptations to new environments.

Finally CLIMIT will test current ideas for adaptive management to conserve myrmecophiles on existing and new sites across landscapes, and will model the potential for the mitigation of global change impacts.

Project Partners

UFZ	Helmholtz Centre for Environmental Research (Germany)
UJAG	Jagiellonian University Krakow (Poland)
Pensoft	Pensoft Publishers Ltd (Bulgaria)
S4you	Science4you (Germany)
UOxford	University of Oxford (UK)
BCE	Stichting Butterfly Conservation Europe (International Org., NL)
UBourne	Bournemouth University (UK)
SIB-RAS	Institute of Cytology and Genetics Novosibirsk (Russia)
UTurin	Università degli Studi di Torino (Italy)
ULund	Lund University (Sweden)
NERC	NERC Centre for Ecology & Hydrology (UK)
SWT	Somerset Wildlife Trust (UK)
NT	National Trust (UK)
MNHN	Museum National d´Histoire Naturelle, Brunoy (France)
EIA	Pfeifer -Environmental Impact Assessment (Germany)

Further information: http://www.climit-project.net

Most relevant publications so far:

Thomas JA, Simcox DJ, Clarke RT (2009): Successful conservation of a threatened Maculinea butterfly. *Science* 325, 80-83.

Settele J, Kühn E (2009): Insect Conservation. *Science* 325, 41-42.

Nature-based adaptation or adaptation-based nature?

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By the end of the 21st century, climate change, which has been influencing biodiversity at all its main levels, is supposed to be the main driver of biodiversity loss globally (MA 2005, Parmesan 2006).

Ecosystems respond to climate change through individual species or guilds. Ecosystem functions and thus ecosystem services are not anonymous but they are mostly carried out by species and guilds. Species respond to climate change in three ways: (1) adaptation (2) following their climate zones either towards the poles or to higher elevations (3) becoming extinct. Only long-term (> 10,000 years) persistent climatic trends in the past led to the evolution of new species adapted to the new conditions (Lister 2004).

Generally adaptation sensu lato is the evolutionary process whereby an individual, population or species become better suited to their habitats. Ecosystems and landscapes adapt themselves to climate change through species and their guilds/communities/assemblages. Although signatures of climate change are clearly visible in many ecological processes, similar examples of microevolutionary responses in literature are in fact very rare.

Recent, rapid climate change is driving evolution, as organisms adapt to altered seasonal events rather than to the direct effects of increasing temperature change, and is likely to impose strong selection pressures on traits important for fitness. Therefore, microevolution in response to climate-mediated selection is potentially an important mechanism mitigating negative consequences of climate change (Bradshaw & Holzapfel 2006). Climatic change may exert selective pressures favouring genotypes within a species' population that are better-adapted (e.g. physiologically, behaviourally or morphologically) to the new conditions. Thus at least some phenological responses have been shown to be genetically controlled, as have some observed changes in migratory strategy. The extent of such responses, however, will vary amongst species according to their inherent genetic variance. The extent to which such responses will be apparent will also vary according to the location examined; the greatest magnitude of response is likely to be seen at locations close to the 'leading edge' of a species' distribution relative to a climatic change, whereas most species are unlikely to exhibit any adaptive response at locations close to the 'trailing edge' of their distribution. Where they occur, however, such responses may be achieved within only a few generations (contemporary evolution), although how long this represents will depend upon the longevity and/or age at first breeding of the species examined (Huntley 2007).

Small animals with short life cycles and large population sizes will probably adapt to longer growing seasons and be able to persist; however, populations of many large animals with longer life cycles and smaller population sizes will experience a decline in population size or be replaced by more southern species. Questions remain about the relative rates of environmental and evolutionary change.

The available evidence points to the overall conclusion that many responses perceived as adaptations to changing environmental conditions could be environmentally induced plastic responses rather than microevolutionary adaptations (Gienapp et al. 2008). Therefore, climate change affects on species can be

also studied at the genetic level: results can be used in implementing the ecosystem-based adaptations to climate change as much as possible (Reed et al. 2011).

Contemporary evolution is associated with the same factors that are driving the current extinction crisis. Climate change may accelerate evolution in some species but that does not guarantee that threatened populations will cope in the long run (Husby et al. 2011).

Enhancing natural adaptation of biodiversity through conservation and management strategies to maintain and enhance biodiversity can reduce some of the negative impacts from climate change and contribute to climate change mitigation by preserving carbon sequestration and other key functions. However, there are levels of climate change for which natural adaptation will become increasingly difficult, especially where surrogate conditions may be absent or disconnected.

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Rethinking what is a 'native' and 'non-native' species as ranges shift as a result of climate change

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Species are on the move as a consequence of recent climate change (Parmesan 2006), including both, native and non-native species (Walther et al. 2009). The pathways of shifting species include several options: some species are able to migrate from their place of origin to the new habitat; for others, humans played an important role as disperse vectors; and for a third group of species, it is not clear to what degree they were able to migrate by their own or to profit from human assistance. This may be one reason, why with continued climate warming it will become increasingly difficult to assess the status of new arriving species at the recipient habitat. Furthermore, Williams (1997) raised the question for potential valuable functions of nonindigenous plants: "„ ... rapid reorganization of ecological communities will occur with indigenous species shifting ranges or becoming extinct, and preadapted non-indigenous species invading vacant niches [...]. In this regard, an non-indigenous species considered problematic today may have considerable ecological value in the future, perhaps playing key structural and functional roles in post-climate change communities." Hence, with concern now increasing on the possibility of global mean temperatures rising to 4°C above pre-industrial or beyond" (Betts et al. 2011), there might be both, risks and opportunities for alien species to be considered in a warmer world (Walther et al. 2009). The latter is supported by the projected disappearing and novel climates by the end of the 21st century (Williams et al. 2007), with obvious consequences for the existence of species and composition of communities (Fig. 1).

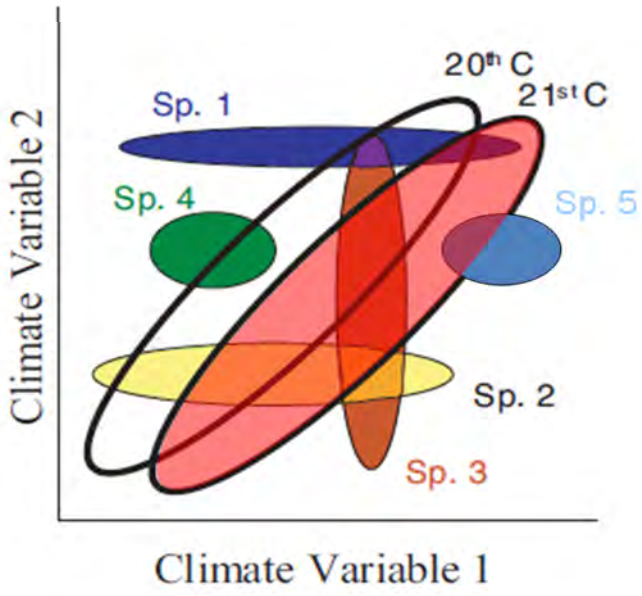

Fig. 1. Species co-occur if their fundamental niches simultaneously intersect with each other and the current climatic space. As a consequence of climate change, shifts in species' distribution occur (species 1–3) that may induce community disaggregation (species 1 and 3), new communities forming (species 2 and 3), extinction (species 4), and new opportunities for species survival (species 5) (Williams et al 2007, modified).

An example of how a novel community resulting from recent climate change may look like is developing at the southern foot of the Alps. Climate change, especially winter warming exceeded an ecologically important threshold of 2 °C average temperature of the coldest month. Under the existing precipitation regime and with winter temperatures below that threshold, deciduous broad-leaved species dominated, whereas above that threshold, climate becomes increasingly favourable for evergreen broad-leaved species, and lead to the local formation of a mixed community of native and non-native woody species (Walther et al. 2007).

For species being not able to track climate change and facing high risk of decline or extinction, undertaking human assisted translocation (assisted migration) has increasingly been discussed in recent years (Hoegh-Guldberg et al. 2008). According to the Australian Adaptation Research Network for Terrestrial Biodiversity: "Guided assisted migration will require an experimental and timely approach and adaptive management should be a priority. Vulnerable species should be monitored to detect declines and identify causes. We will need robust protocols to help determine which species to move and when to move them, and to decide whether translocation is economically efficient, ecologically safe and socially acceptable."(http://hosting2.arcs.org.au/terrestrialbiodiversity/download/information_sheet_2_assisted_migration.pdf).

However, some species have already profited from assisted translocation: a comparison of the natural ranges of 357 native European plant species with their commercial ranges, based on 246 plant nurseries throughout Europe, have shown that in 73% of native species, commercial northern range limits exceeded natural northern range limits, with a mean difference of ~ 1000 km (Van der Veken et al. 2008).

Shifting native and non-native species' ranges (Walther et al. 2009), the projection of novel climates with non-analogue communities and disappearing climates (Williams et al. 2007) with the risk of species' decline or extinction resulting the discussion about pros and cons of human assisted migration (Marris 2008), makes it increasingly difficult to define an exotic species: "Currently, the term exotic is commonly used for species that have become established beyond their historic range through direct or indirect human invervention at some particular point in time. [...] this definition will become increasingly outdatet and controversial with climate change as native species move to novel areas or are introduced to sites other than their known historical or current occurrences." (Kutner & Morse 1996).

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1.5 Special session on forecasting climate change impacts

Forecasting bird population changes in response to global warming using high resolution models - lessons learned from Germany

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Hitherto, models on bird distribution change due to climate warming were generally conducted at relatively coarse resolutions, often using a 50 km grid and thereby ignoring local differences in habitat use and topography. Here, I present challenges and achievements related to forecasting bird population changes at a high spatial resolution (25 x 25 m) and across a national scale (357 000 km²). We used data of the German Common Breeding Bird Survey (approx.. 300,000 breeding bird records), a high resolution land-use map and climate data from regional climate simulations to forecast the populations of 45 common terrestrial bird species in Germany under expected climate change. Bird abundances were estimated from raw census data using Distance Sampling. Resource selection functions were devised using Generalized Linear Models, and were then applied to maps of the present state and to simulated maps of the IPCC climate scenario A2 for the year 2050. Data availability, harmonization of data from different sources, and large processing time of the high resolution maps proved the greatest technical hurdles of the project. Spatial projections of climate impacts varied strongly between species.

Among the 45 bird species examined, population size was predicted to decrease by more than 0.5 million breeding pairs for 12 species and to increase by more than 0.5 million breeding pairs for 3 species until 2050. The greatest relative decline in population size (> 50% loss) was predicted for Eurasian Treecreeper, Common Pheasant, Lesser Whitethroat, Icterine Warbler, Dunnock, Willow Warbler, Song Thrush and Goldcrest. Despite these climate-driven changes, our results suggest that suitable habitat for birds will be more susceptible to future changes in land use. The talk evaluates whether modelling at fine spatial resolution is worth the effort and discusses options for future work.

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Gottschalk TK (in press): Vogelmonitoring als Datenbasis für Modelprognosen. Sudfeldt, C, Dröschmeister, R & Wahl, J (in print): Vogelmonitoring in Deutschland - Programme und Anwendungen. - Naturschutz und Biologische Vielfalt, ca. 350 p.

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An Introduction to using the GBIF Informatics Infrastructure

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Global Biodiversity Information Facility

The Global Biodiversity Information Facility was established by OECD countries to assist them with common biodiversity informatics challenges. GBIF is open to all countries, and as such, GBIF has a multilateral mandate to develop global common data standards, exchange protocols and tools and services for free and open uptake by users worldwide. This presentation will provide an overview of the GBIF informatics infrastructure, tools and services for uptake by the biodiversity community to assist and enable improved access, discovery, sharing, curation, management and of biodiversity data.

Further information

- GBIF Web site: http://www.gbif.org
- GBIF Data Portal: http://data.gbif.org
- Data standards: http://www.gbif.org/informatics/standards-and-tools/publishing-data/data-standards/
- Publishing software: http://www.gbif.org/informatics/standards-and-tools/publishing-data/publishing-software/
- Publishing metadata: http://www.gbif.org/informatics/discoverymetadata/publishing/
- Publishing primary biodiversity data: http://www.gbif.org/informatics/primary-data/publishing/
- Publishing names: http://www.gbif.org/informatics/name-services/publishing/
- Web services: http://www.gbif.org/informatics/standards-and-tools/using-data/web-services/

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1.6 Session III: Integrated and ecosystem-based approaches to climate change adaptation and mitigation

Possibilities and limitations for biodiversity conservation in a climate change adaptation framework under the UNFCCC

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In its 15th Conference of the Parties in Cancún the United Nations Framework Convention on Climate Change adopted the Cancún Adaptation Framework. This includes a broad set of activities, functions bodies and platforms which catalyze support to country-led adaptation activities on national and sub-national level. In particular, support is to be geared towards developing countries such as Small Island Developing States, Least Developed Countries and Sub-Sahara Africa. Adaptation encompasses many aspects; ecosystems and biodiversity being one of them. The potential for conserving biodiversity and integrating ecosystem approaches within the convention lies primarily in the knowledge exchange platforms, coordinating instruments, and especially in national level uni-, bi- and multilateral action. Through such elements of the convention as the Nairobi Work Programme knowledge on ecosystem based approaches can be shared, and gaps as well as calls for action identified. However most important for ensuring coherency in adaptation and conservation policy is cooperation of Parties and Partners of the Convention (for example an OECD task team has brought together environment and development ministries to exchange on adaptation) to ensure that in implementing the Adaptation Framework ecosystem services are protected, ecosystem approaches are considered and adaptation policy is coherent with conservation policy. In this regard, the EU particularly supports the interlinkages between the Multilateral Environmental Agreements (UNFCCC, UNCBD, UNCCD) e.g. through strengthening of ecosystem-based adaptation.

ICI – The German International Climate Initiative, an innovative financing mechanism for the conservation of climate and biodiversity

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Since 2008, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has been supporting model climate protection projects in developing and newly industrializing countries as well as in countries in transition through its International Climate Initiative (ICI). The funds stem from the auctioning of tradeable emission certificates. The ICI supports the implementation of the Copenhagen Accord and encourages the formulation of a consensus for an ambitious climate agreement after 2012. The ICI is a part of the German contribution to "fast start financing". Its focus lies in the following areas: I) Promoting a climate-friendly economy / mitigation; II) adaptation to climate change; III) preservation and sustainable use of carbon sinks / Reducing Emissions from Deforestation and Degradation (REDD+).

Projects in focal area III and projects focusing on ecosystem-based adaptation in focal area II offer good opportunities to make use of the synergies between the conservation of biodiversity and climate. Biological diversity can be essential for maintaining the stability – and thus the ability to store carbon - of carbon-rich ecosystems. Furthermore, biodiversity-rich systems create additional "co-benefits" (e.g. water supply, food production, safeguards against catastrophes) that in turn increase the capacity of the people who depend on them to adapt to climate change.

The projects are oriented towards the needs of the partner countries. Up to now, 220 projects with a total volume of over 450 million Euros have been supported in over 60 partner countries. Of these, over 60 projects with a total volume of around 150 million Euros contribute to the conservation and sustainable use of biodiversity-rich ecosystems, such as forests, mangroves, coral reefs, peatlands and other wetlands. Typical measures that are being supported include capacity building, the creation of new protected areas (PA) and improved PA management in support of the LifeWeb Initiative of the Convention on Biological Diversity (CBD), the reduction of deforestation, the restoration of degraded areas (including through rewetting, afforestation and reforestation), the creation of information and communication platforms, payment systems for ecosystem services (PES), sustainable forestry and agriculture and the implementation of requirements from international agreements through national strategies and administrative structures, as in e.g. REDD+.

Using a project implemented in China by GIZ and co-supervised by the BfN („Sino-German Cooperation Platform for the Conservation of Species-Rich, highly Carbon-Storing Ecosystems") as an example, we demonstrate how the synergies between biodiversity conservation and climate protection can be utilized and integrated into the management of protected areas. This approach is implemented by using instruments such as the provision of short and long term experts for technical counselling of Chinese partners, the design and implementation of education and training courses of Chinese practitioners e.g. protected area managers, the support for the improvement of administration structures concerned with the

cultivation of carbon-storing and species rich ecosystems as well as through the establishment of a database and atlas on carbon-storing ecosystems and their biodiversity.

Together with UNEP-WCMC a carbon & biodiversity atlas was developed for the pilot region Jiangxi (see summary of Monika Bertzky). This mapping tool should help to identify how carbon, biodiversity and other ecosystem services are distributed across the landscape and relate to each other. The aim was to highlight areas where high carbon density coincides with areas of importance for biodiversity and to provide protected area managers and politicians support for decision making where to secure biodiversity as a co-benefit from carbon management. Another important activity in the project is the training of protected area managers in vulnerability assessment which was done by Eberswalde University for Sustainable Development. The basic idea for accomplishing this vulnerability assessment was to identify the main stresses and threats the protected areas are facing, and then classify the stresses & threats as being climate related vs. climate independent. The most urgent and related ones in context of climate change shall be considered and implemented with a high priority in protected area management strategies and management plans.

Two of the conclusions of the project are that spatial analyses are very helpful to identify and use co-benefits of carbon sequestering, biodiversity and human well-being inside and outside protected areas, and that vulnerability assessment in protected areas leads to a more adapted and systematical formulation of management strategies, especially when it comes to the mitigation and adaptation of climate change.

In a research and development project of the BfN currently under preparation, criteria for the improved consideration of biodiversity aspects in forest and wetland projects in the ICI will be developed. The results shall serve to improve the ICI, to strengthen biodiversity aspects in the UNCBD and UNFCCC and to act as a guide towards good practice.

Further information about the ICI

www.bmu-klimaschutzinitiative.de/en

- Further information about the ICI-Project in China
  www.biodiversity-climatechange.org
  www.bfn.de/0310_klimaschutz+M5054de7a952.html

- Further information about the LifeWeb Initiative of the CBD
  http://www.cbd.int/lifeweb/

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Greening REDD+: challenges and opportunities for forest biodiversity conservation

Progress of research in the BfN-funded project *The Protection of Forests under Global Biodiversity and Climate Policy*

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Background

The REDD+ mechanism currently being negotiated under the United Framework Convention on Climate Change (UNFCCC) is perceived as a potentially powerful instrument to mitigate CO_2 emissions from deforestation and degradation activities in developing countries. REDD+ may yield additional benefits for biodiversity conservation and ecosystem services. However, a deficiently designed REDD+ mechanism bears the risk of inducing negative impacts on biodiversity (e.g. plantations or inter-ecosystem leakage).

This project seeks to develop policy approaches as well as practical recommendations that help trigger synergies between climate change mitigation and biodiversity conservation objectives – as negotiated under the UNFCCC and the Convention on Biological Diversity (CBD), respectively. Specifically, it aims to identify options and requirements for the integration of biodiversity safeguards into REDD+ policies at various governance levels (international, national and project level).

Biodiversity safeguards, so far stipulated in a rather rudimentary and general fashion under the UNFCCC, need to be specified and adapted to individual country situations. In this respect, the project provides analyses of different international governance settings (e.g. under the interim REDD+ Partnership) and the REDD+ implementation processes at the national and subnational level.

The interim REDD+ Partnership: Boost or bust for REDD+ under the UNFCCC? (Sub-project 1)

The REDD+ Partnership emerged as an output of the efforts initiated under the Informal Working Group on Interim Finance for REDD+ (IWG-IFR) and constitutes a voluntary governance setting that expires in 2012. With respect to the unsatisfactory pace of the negotiations under the UNFCCC, particularly after the failure of Copenhagen, it pursues the objective to further current activities to make countries "ready for REDD" by scaling "up REDD+ actions and finance, […]" (REDD+ Partnership 2010).

Established outside the negotiations, the initiative basically serves as an interim financial mechanism to enable developing countries to develop and implement national REDD+ strategies. Within the setting, cross-cutting issues that are highly relevant to climate change and forest biodiversity, such as biodiversity safeguards, are also under discussion. In this regard, the process faces the dilemma not to preempt the negotiations, while fulfilling the desires of various Parties to make REDD+ quickly operational in an environmentally integer mode. On the one hand, the process can make REDD+ more comprehensive by

taking into account other environmental objectives and thus building a bridge between the objectives of UNFCCC and CBD. On the other hand, it may potentially and counterproductively withdraw countries' ambitions to further engage within and commit to the respective established international processes.

Accordingly, the objective of the sub-project is to:

Assess requirements and chances of a networked governance arrangement (Type-2 partnership) on REDD+ to trigger norm-setting on a voluntary basis, e.g. for the definition and implementation of biodiversity safeguards at national level.

Discuss in how far this arrangement (i.e., the Partnership) may serve as an innovative, effective and efficient complement, or alternative, to the existing international and national governance modes.

The research builds on a systematic review of relevant governance literature as well as on an analysis and active observations of the Partnership process.

Biodiversity values in climate change mitigation activities: Forest conservation and REDD+ in Peru (Sub-project 2)

Regarding the implementation of REDD+ at the national and subnational level, identifying biodiversity components of high protection value is an important prerequisite for defining environmental safeguards. As part of a case study in Peru, an interview survey with REDD+ stakeholders (n=50) was carried out in order to identify aspects of biodiversity possibly affected by REDD+ activities that have conservation priority at the national and local level.

Due to the fuzziness and the very broad scope of the concepts for biodiversity and ecosystem services, it is often unclear to what the terms *environmental safeguards* and *additional benefits* exactly refer to in the context of REDD+. Therefore the biodiversity values mentioned in the interviews were classified according to a common valuation approach, allowing for a more structured discussion on priority setting and monitoring requirements.

The study revealed that although biodiversity is generally regarded as important for the economic and ecological long-term viability of REDD+ in Peru, there is little awareness regarding concrete additional benefits. High-priority conservation targets and additional benefits of REDD+, when mentioned by interviewed REDD+ stakeholders, basically encompassed non-carbon ecosystem services, especially the provision of hydrological services originating from forested watersheds. Importance was also attributed to native timber and non-timber species with high market values. Beside such use values, emblematic and threatened species were perceived as important compositional components of biodiversity in Peru.

The results of the case study also indicate that monitoring the impacts of REDD+ activities on forest biodiversity is still a challenging task in Peru. Information on biodiversity is often restricted to lists of species, whereas little knowledge exists on functional and structural biodiversity components. In many cases, existing biodiversity databases are not interconnected. In this respect, harmonisation of already established research institutions and their integration into national REDD+ processes appear as promising strategies to generate data and information for improved management decisions on biodiversity conservation and the sustainable delivery of ecosystem services, especially in the light of global climate change.

Further information

http://www.landespflege-freiburg.de/forschung/redd.en.html

http://portal.uni-freiburg.de/ifp/FoPo/forschung/redd

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Carbon, biodiversity and ecosystem services: Using maps to explore co-benefits from climate change mitigation

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Climate change mitigation measures are usually aimed at conserving or enhancing forest carbon stocks. However, there is great potential for such measures to also deliver other benefits, such as biodiversity and ecosystem services. Whether or not they will do so in practice depends on careful planning that takes into account the scientific and spatial complexities around carbon and other benefits. Exploring opportunities and risks for carbon and co-benefits in the planning for climate change mitigation measures, including Reducing Emissions from Deforestation and forest Degradation, as well as conservation of forest, sustainable management of forest and enhancement of forest carbon stocks (REDD+), can support decision-makers in these planning processes. UNEP-WCMC, with support from BfN, BMU and the UN-REDD Programme, has been working on multiple benefits from REDD+ for more than three years. In addition to awareness raising on multiple benefits at global scale, a major focus has been on supporting national level preparation for REDD+ in a targeted and collaborative way.

National level support has been provided to Honduras, Ecuador, Cambodia, Nigeria, Tanzania and China (Jiangxi Province) and work is ongoing with Liberia, Argentina, the Democratic Republic of Congo and Indonesia. In this national scale work, emphasis is placed on taking into account the needs and priorities of the different countries, with the aim to producing outputs that are of relevance in the various country contexts. The work addresses a number of different policy questions of interest to the planning of multiple benefits from climate change mitigation measures, some of which were presented, each using one national example:

1) **How much of the areas that are high in carbon and important for biodiversity are protected?**
   Example: In Cambodia, more than three quarters of the area that is high in carbon and an Important Bird Area is either inside protected areas or in Protection Forests (Kapos et al. 2010).
2) **What are current pressures on carbon stocks and where do they occur?**
   Example 1: In Nigeria, 50% of the total carbon is stored in oil and gas contract blocks (13%), and areas designated for exploitation but not yet contracted (37%, Ravilious *et al.* 2010).
   Example 2: In Ecuador, 60% of the country's biomass carbon is within 10 km of areas of recent forest cover loss (Bertzky et al. 2010).
3) **What is the role of the forest in stabilising the soil?**
   Example: 81% of the forest land in Jiangxi Province potentially suffers from extremely severe soil erosion, but forest cover reduces erosion from extremely severe to negligible in 78% of the province (Lin et al. 2010).
4) **How much more carbon could be sequestered?**
   Example: Many forests in Jiangxi Province are of young age. A preliminary estimate suggests that the total carbon stock of the province could increase by almost 45% if these young forests reached maturity (Lin et al. 2010).

Apart from presenting examples from the more detailed national scale work, a series of twelve "short country profiles" was launched at the conference (Bertzky et al. 2011), i.e. for Benin, Burundi, Cameroon, Côte d'Ivoire, Ghana, Guinea, Kenya, Rwanda, Sierra Leone, Togo, Uganda and Zambia. These profiles are based on global and regional data for carbon (Baccini et al. 2008, Scharlemann et al. in prep.), biodiversity (here Key Biodiversity Areas, BirdLife International and Conservation International 2010), and protected areas (IUCN and UNEP-WCMC 2010). They provide estimates for the amount of carbon stored in each country, highlight areas of high carbon and how these areas relate to biodiversity (here Key Biodiversity Areas), and calculate how much of the area of high carbon and importance for biodiversity is inside protected areas. While any future work with these countries should be conducted in close collaboration with national stakeholders and institutions, the profiles represent a first step in exploring multiple benefits from carbon management for climate change mitigation in these twelve countries.

While this work is based on simple spatial analyses, the products are valuable for several reasons: First, the maps are considered powerful awareness raising tools that can help make the case for multiple benefits from climate change mitigation, including REDD+. Second, they present a good starting point to think about factors that may need to be taken into consideration in the planning and implementation of such measures. And third, the data compilation process that is part of the work in each case helps countries understand the state of relevant information and needs for updating of data and further data gathering, which is an essential step in preparing for multiple benefits from climate change mitigation measures.

In the context of this conference, which looked at biodiversity and climate change in science, policy and practice, this work can be considered to be located at the interface between science and policy, i.e. using best available scientific data to address policy questions of importance to different country contexts. For more information on these and other global and national multiple benefits related work conducted by UNEP-WCMC with support from the German government, please visit www.carbon-biodiversity.net.

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The West European Climate Corridor - A strategy for climate adaptation in the Rhine basin

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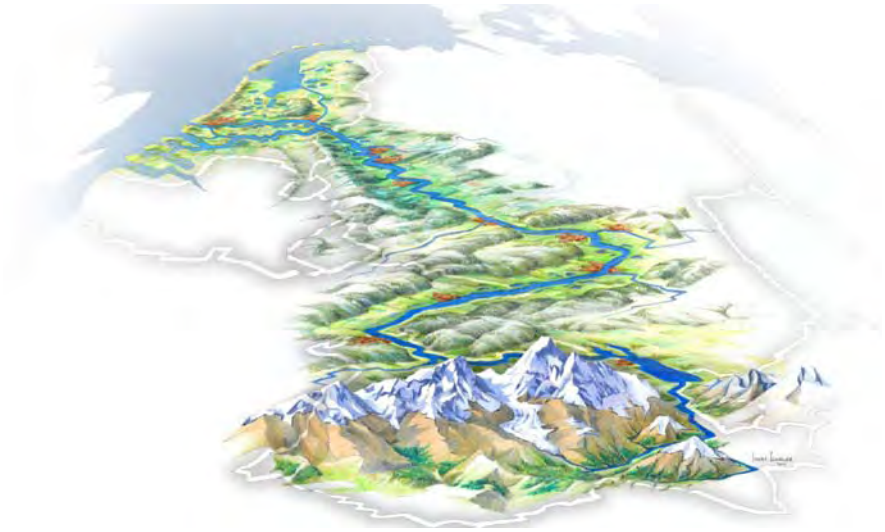

One of the major effects of climate change is an increase in temperature, which leads to changes in the hydrological cycle which will consequently affect the water discharge off streams and rivers. The effect can be detrimental in two ways: it may increase floodings, and it can result in long periods of severe drought as well. Both events can have a great impact on all sectors of our society, like agriculture, industry and energy production, ship traffic, drinking water supply, tourism and biodiversity.

The question is: can environmental enhancement help to adapt our society to problems caused by climate change? The West European Climate Corridor is a strategy for climate adaptation in the Rhine basin and could provide the answer. The WECC serves a broad spectrum of benefits and is developed around a system of natural climate buffers. This means that the entire society, including socio-economic, environmental and natural aspects will benefit from this strategy.

Due to climate change the entire Rhine basin is affected by a gradual shift from snowfall towards increasing rainfall in winter, and less precipitation and more evaporation in summer. Historical records and the expected changes in the hydrological cycle, indicate that future water discharges of the Rhine system will be much less in summer and autumn. Changes in the water conserving conditions of the Alps are crucial in this case, because the Alps are the most important provider of surface water in dry periods. And not just for the Rhine, but also for various other major European rivers like the Rhône, Po and Danube. This is why the Alps are known as the ‘Water towers of Europe’.

Rehabilitation of the capacity of soil and landscape to retain water by increasing the natural water storage capacity of arable land, by re-naturalization of streams and rivers and by expanding natural areas like moors, wetlands and forests is the crux of the West European Climate Corridor. The implementation of

ecologically-based climate adaptation measures will strongly benefit the European biodiversity goals in the Rhine basin. And in general this strategy is also valid for river basins elsewhere in Europe.

Further information

http://www.gelderland.nl/Documenten/Themas/Milieu_Klimaat_en_Water/Klimaat/klimaat%20en%20water/WECC_English_Report.pdf

http://www.gelderland.nl/Documenten/Themas/Milieu_Klimaat_en_Water/Klimaat/klimaat%20en%20water/WECC_English_brochure.pdf

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Achieving climate mitigation and adaptation without compromising nature: experiences from the CIPRA projects cc.alps and ecological networks

AURELIA ULLRICH

CIPRA International

In a time of climate change the protection of nature is more urgent than ever. Therefore measures to protect the climate whose ecological consequences are worse than climate change itself must be avoided at all cost. The results of CIPRA's cc.alps project help to align measures to protect the climate in the Alps with the principles of sustainable development.

The Rombach case – more hydropower compromises freshwater biodiversity

The Rombach is a small river which has its source in the Swiss Alps and then crosses the border to Italy. In Switzerland, the Rombach has been successfully revitalised and a biosphere reserve has been established. In Italy, there are plans to build a hydropower plant. This would be an interesting source of renewable energy but in the same time interrupt the ecological continuity of the river.

The Rombach is not a single case. Nowadays there are more and more plans to increase hydropower production by building new power plants. Already 20 years ago a study commissioned by CIPRA stated that only 10% of Alpine river stretches are still in a near natural state. So even if from the climate change point of view more small and large hydropower stations would be a benefit – for the biodiversity in Alpine rivers they constitute a major problem.

The political framework in the Alps

With the Alpine Convention the Alpine states dispose of a common contractual framework for sustainable development. In addition to the framework convention and its thematic implementation protocols, the Environment ministers have adopted an action plan on climate change in 2009. With the long term goal of converting the Alps into a model region for climate change, the Alpine States have formulated a series of objectives in various thematic fields among which the biodiversity topic. Actions which should be supported are the creation of ecological networks, preservation of biodiversity in protected areas and protection of typical Alpine species, a quality agriculture and the maintenance of peatlands.

The Alps in times of climate change

This joint ambition to act against the consequences of climate change has a good reason. The Alps are among the regions in Europe which feel the consequences of climate change very strongly already today. In fact, compared to the global average, the trend for higher temperatures and altered precipitation regimes is twice as high in the Alps. Melting glaciers and shifting of habitats of plants and animal species are only two examples for resulting consequences.

People in the Alps have started to adapt against the consequences of climate change with producing artificial snow, with plastic sheets slowing down the further melting of glaciers or with more protection measures against natural hazards. And people are also trying to mitigate climate change by constructing energy efficient houses or by erecting new dams for more hydropower use.

Thinking a step further: CIPRA‘s cc.alps project

Considering this multitude of actions which are undertaken in the Alps because of climate change, this is where CIPRA‘s cc.alps project starts. CIPRA goes one step further and asks about the consequences of mitigation and adaptation activities on nature, on economy and on society. With the cc.alps project CIPRA wants to contribute to make climate response measures more sustainable.

A wide range of climate measures has been collected and evaluated. Based on these results, CIPRA warns people to implement measures which are not sustainable and promotes those measures which are sustainable and which can serve as good examples. One way to reach this is the publication of the collected knowledge in topic related booklets. These „compacts“ summarise the interrelations and the conflicts between climate change and each sector such as tourism, energy or nature protection. Each of the compacts also contains some recommendable good practice examples.

Good practice examples: ecological networks and dynAlp-climate

The following two biodiversity related projects can be considered as successful in terms of sustainability.

In order to facilitate migrations of animals and plants across the entire Alpine range and thus contribute to conserving the extraordinary biodiversity of the Alps, a wide range of actors work towards the establishment of an Alps wide ecological network. Since 2007 this generation spanning task is tackled in particular by three initiatives: Under the framework of the Alpine Convention, the „Platform Ecological Network“ makes sure that there is sufficient political support in all Alpine countries for improving ecological connectivity. In contrast to the many small actions which are undertaken without considering the larger or even Alps wide context, a coordinated approach is implemented to realise networking activities on the ground in seven „pilot regions“. This is happening within the „Econnect“ project which is co-funded by the EU. In addition to these publically supported activities, three NGOs (the Network of protected areas Alparc, the Committee for research in the Alps Iscar and CIPRA) are working towards the long term vision of an Alps wide ecological continuum (the “Ecological Continuum Initiative”).

The second example shows you the positive engagement by municipalities all over the Alps. The network of municipalities „Alliance in the Alps“ created a 2 years funding program in order to support its member municipalities to cope with climate change in a sustainable way. In the framework of this program 20 implementation projects receive a co-funding with a total sum of 300.000 €. One of these 20 projects takes place in the South-Eastern Italian Alps at the Tagliamento river, one of the last remaining large natural rivers. Biodiversity in this river is threatened by the planned construction of retention basins inside the river bed for a better flood protection. With the help of dynAlp-climate, the municipality of Pinzano promotes existing alternative solutions among neighbouring municipalities and the population. A film raises awareness on the topic e.g. in schools, a book is being produced and workshops and excursions are organised to allow people to experience this unique natural river landscape.

Further information

cc.alps project and “compacts”: www.cipra.org/cc.alps

CIPRA’s activities on ecological networks in the Alps: www.alpine-ecological-network.org Network of municipalities Alliance in the Alps and dynAlp climate project: www.alpenallianz.org

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1.7 Session IV: Socio-economic aspects and integration with other sectors

Valuation of ecosystem services in Mediterranean forests

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Keywords: Mediterranean forest; timber provisioning; carbon sequestration; economic valuation; extensive management; intensive management; GIS.

The science of ecosystem services has evolved significantly in the last decade following an increasing interest on the understanding and valuation of these services. Forests provide important ecosystem services that supply societal needs, such as timber or carbon sequestration, but this provision is not free of conflicts derived from the intensive management of forest plantations. A GIS based approach using data from national forest inventories allows us to identify and value the provision of timber services. The analysis includes a sample of 37,761 plot observations for 38 commercial tree species in the Spanish Mediterranean region, identifying extensive and intensive managed forest in order to value both timber and carbon ecosystem services. From the analysis, we obtain that intensively managed forests provide higher economic returns for most abundant tree species than extensively managed forests. However, when analyzing long term trends, results show that extensive forests are yielding higher economic benefits. This latter perspective is preferred when looking at the value of timber as a provisioning service of forests. Benefits from carbon uptake by forest biomass are also analyzed and compared to timber benefits, obtaining that unsustainable harvest leads to carbon release in many cases. Implications for management and conservation of forest ecosystem services are further discussed.

Paludiculture for biodiversity and climate – economics of rewetted peatlands

ACHIM SCHÄFER

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A peatland is an area with a naturally accumulated peat layer at the surface. Peatlands are characterised by the unique ability to accumulate and store dead organic matter, as peat, under conditions of almost permanent water saturation. Pristine peatlands are among the last remaining wildernesses on Earth. They provide habitats for many rare species and have increasingly become refugia, also for non-peatland species. They also enhance freshwater quality and hydrological integrity, carbon storage and sequestration and are important for the global carbon cycle. They cover over four million km^2 or 3% of the land area but contain 30% of the world's soil carbon, an equivalent of 60% of all atmospheric carbon, and as much carbon as all terrestrial biomass (Joosten & Couwenberg 2008).

Peatlands are used by many stakeholders for agriculture, forestry, fuel production, industry, and for other aims. They are important for welfare because they satisfy many essential human needs. The range and importance of the diverse functions, services and resources provided by peatlands are changing dramatically with the increases in human demand for use of these ecosystems and their natural resources.

The global area of peatlands has been reduced significantly, particularly by drainage for agriculture and forestry. Drainage causes decomposition of the peat: the soil carbon reacts with the oxygen that penetrates the soil to form carbon dioxide. Globally, peatland related emissions amount to over 2 gigatonnes of CO_2 per year (Joosten 2009). These emissions are much larger than the carbon sequestration capacity of untouched peatlands and the main reason why peatlands are important for the global carbon cycle. Furthermore, the ongoing degradation of peatlands leads to substantial losses in biodiversity, water, and nutrients, as well as to decreases in the quantity and quality of fodder production.

Estimating the marginal costs of avoided damage are one important economic indicator for evaluating the damages of drained and the benefits of rewetted peatlands. The agricultural use of peatlands in Germany comprises 930.000 hectares and every year emits the large amount of 20 megatonnes CO_2-eq into the atmosphere. Agricultural use of drained peatlands does not meet the demands of sustainable land use, nor the principles of good agricultural practice. Without environmentally harmful subsidies, such as direct payments within the EU Common Agricultural Policy or incentives of the German Renewable Energy Sources Act, most fen grasslands would be abandoned and be left to natural succession. According to the recommendation of the German Federal Environment Agency, marginal damage costs have to be considered in benefit-cost calculations of public projects with a proxy of 70 Euro per tonne CO_2 (Federal Environment Agency 2007). The damage costs of the unsustainable agricultural use in Germany are in this case in the magnitude of 1,4 billion Euros per year.

Mitigation costs denote the cost of avoiding an incremental unit of a greenhouse gas emission. Rewetting drained peatlands reduces the emissions of greenhouse gases substantially, and in some cases results in peat formation and associated carbon sequestration. Rewetted peatlands may contribute to climate change mitigation in two ways: (i) by reducing greenhouse gas emissions from drained peatland soils and (ii) by replacing fossil resources by providing renewable biomass alternatives (Wichtmann & Schäfer 2007). The

cultivation of biomass on wet and rewetted peatlands, so-called paludiculture, is an ecosystem based approach to climate change adaptation and mitigation. Paludicultures are an innovative alternative to conventional drainage-based peatland agri- and silviculture (see http://www.paludiculture.com/). Ideally, paludiculture peatlands should be wet enough so that peat is conserved and peat accumulation is re-instated (Wichtmann et al. 2010).

A sustainable land use which paludicultures provide decreases greenhouse gas emissions from the peat soil and allows the production of biomass and timber to replace fossil raw materials and fossil fuels. From an economic point of view, most paludicultures can also compete with normal drainage based agriculture without rivalry to food production. The mitigation costs of paludicultures in the range of 0-80 Euros per tonne carbon dioxide are comparatively low (Schäfer 2009). Paludicultures are a cheap and effective way to reduce greenhouse gas emissions – in Germany and worldwide.

Paludiculture is a climate change mitigation tool that also benefits rural economies, tourism, biodiversity, water quality and retention. Paludiculture is cost efficient, ready for use and in conformity with the European policy that envisages the replacement of fossil fuels with biomass. Rewetting of drained peatland sites provides species-rich meadows, reed-marshes, alder forests and other valuable habitats (Tanneberger 2008). Such a sustainable use is also in line with the “stop the loss goal” of the biodiversity strategy of the EU.

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2 Abstracts of Poster Presentations

Monitoring and predicting biodiversity change under climate change

CORNELIA KRUG

Climate change has considerable impacts on biodiversity and ecosystems. Species abundances and distributions are changing due to local extinctions and range shifts. Monitoring biodiversity change allows us to track responses of species, communities and ecosystems to climate change, enables us to identify the drivers of change, and pinpoint those areas that are particularly vulnerable to change. The development of effective policy in the face of global change makes it necessary to anticipate future biodiversity change, which depends (in part) on model-based biodiversity scenarios.

DIVERSITAS (http://www.diversitas-international.org), an international programme of biodiversity science, addresses the complex scientific questions posed by the loss in biodiversity and ecosystem services, and offers science based solutions to the crisis. Part of the mission of its core project bioDISCOVERY (http://www.diversitas-international.org/activities/research/biodiscovery) is to improve monitoring and projections of biodiversity change under global (climate) change. To achieve this, a number of projects and implementing activities are coordinated, and the results disseminated to a broad audience.

Biodiversity Scenarios Synthesis: identifying the response of biodiversity to climate change and other global change drivers (http://www.diversitas-international.org/activities/research/biodiscovery/implementation-activities/biodiversity-scenarios)

In a large-scale synthesis study for the GBO3 report, commissioned by the CBD, ecosystem tipping points driven by climate, their mechanisms and their likely impact on biodiversity and ecosystem services were identified. In addition, understanding of mechanisms and certainty of projections were assessed, and key actions to mitigate the effects of climate change were recommended. Climate-driven tipping points include the Arctic Tundra, where wide-spread melting of the permafrost and transformation of the vegetation to boreal forest (taiga) is expected. Marine phytoplankton productivity and diversity will be impacted by increasing ocean temperatures that increase ocean stratification, thus reducing nutrient upwelling from deeper waters.

Shifting Climate - Shifting Vegetation?

The Biome Boundary Shift (BBS) initiative (http://www.diversitas-international.org/activities/research/biodiscovery/implementation-activities/BBS) aims to improve understanding and prediction of mechanisms that drive shifts in vegetation structure and lead to major changes in biodiversity, ecosystem functioning and ecosystem services due to climate change and other global changes. This is achieved by bettering existing vegetation models, the development of new models that are reliable, robust and can be included in earth system models for studying biosphere-atmosphere feedbacks. Current work focuses on the role of dispersal and migration in biome boundary shifts, and the

interactions of climate, fire and vegetation functional and structural diversity in determining savannah dynamics.

Genetic basis of species response to climate change

As an adaptation to rising temperatures, phenological shifts have been observed in a number of species. The genetic basis for this is undocumented, the evidence for adaptive response to climate change is indirect, and it is uncertain how large genetic variation is to allow for adaptation to climate change.

The EcoEvol initative (http://www.diversitas-international.org/activities/research/biodiscovery/implementation-activities/EcoEvol), jointly organised with bioGENESIS (http://www.diversitas-international.org/activities/research/biogenesis), addresses questions concerning the response of species and ecosystems to climate change and contributes to the development or improvement of models that account for both evolutionary and functional processes.

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Spotlights on risks and policy options for Germany's protected areas under climate change

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Climate change is impacting biodiversity directly, e.g., by changing phenology or ranges of plant and animal species. More indirect effects concern a restructuring of biomes. Climate change can also decouple ecological processes.

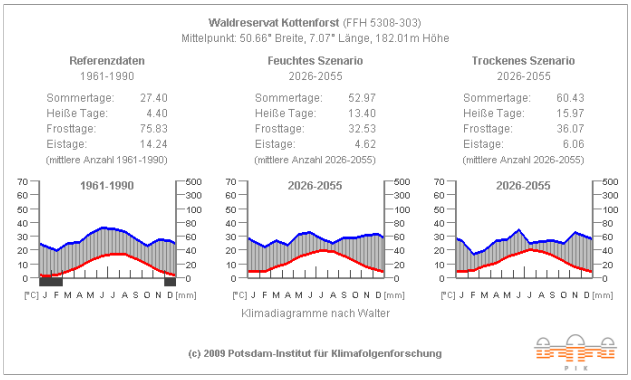

Figure 1 (right). For more than 4000 Natura 2000 sites of Germany climate change scenarios were projected enabling discussions of the consequences of climate change for the respective sites. Here, typical climate parameters and climographs are shown for a selected site. More information is found under http://www.pik-potsdam.de/infothek.

Natura 2000 aims at protecting vulnerable habitats and species across their natural range in Europe to ensure that they are restored to, or maintained at, a favourable conservation status. The Birds and Habitats Directives' annexes target at species and habitats. Some species of the annexes are at risk of being driven out of their current ranges in Germany by climate change. Species establishment under future climatic conditions might be hampered by unsuitable other abiotic and biotic conditions, such as inappropriate land use and soil or absent facilitators or mutualists. Water has a central role; the climatic water balance is projected to decrease especially in summer in most sites.

Communities are especially vulnerable when harbouring cold-adapted species with small ranges. However, widely distributed habitat types will also change their characteristics. Central European beech (*Fagus sylvatica*) forests, for example, may remain relatively resilient against direct impacts while (native) spruce in high montane regions might be outcompeted by broad-leaved trees.

The vulnerability of the sites does not only depend on abiotic and biotic changes but also on the ability to respond to these changes. Therefore, a vulnerability index was developed and applied to a set of 121 protected areas representative for the German system of protected areas in terms of management categories as well as spatial and ecoregional settings.

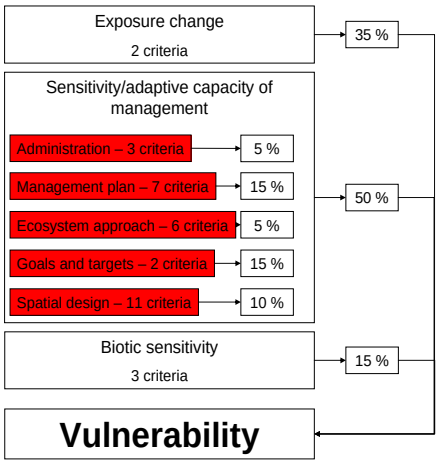

Figure 2 (left) Criteria classes to assess the vulnerability of protected areas against climate change. The criteria classes are aggregated into four blocks that incorporate the common trias of factors contributing to the vulnerability of systems, i.e., exposure change, sensitivity and adaptive capacity. Management is arbitrarily set to determine 50 % of the vulnerability. Similarly, the relative weight of the criteria class was defined based on expert opinion of their importance.

Natura 2000 sites appear more vulnerable than “large protected areas” (national parks, biosphere reserves, nature parks). This is largely due to management deficits, e.g., weak administrations, lack of management plans, non-adaptive management regimes, static, mutually conflicting goals, spatial as well as administrative fragmentation.

A comprehensive book publication (in German) is projected to be published soon.

Further information

Project-Homepage: http://www.pik-potsdam.de/research/research-domains/earth-system-analysis/backups/biodiversity_old/copy_of_schutzgebiete/index_html?set_language=en

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Assessing the vulnerability of the terrestrial natural environment at a large scale

NICHOLAS A. MACGREGOR, SARAH TAYLOR, IAN CROSHER, CHARLOTTE REEVES, HUMPHREY Q.P. CRICK & MIKE D. MORECROFT

The natural environment is already being affected by climate change and changes to individual species and whole ecological communities can be expected to increase as the climate continues to change. But different species and communities will not necessarily be affected equally. In addition, consequences of climate change for an individual species or community are likely to vary from place to place. Successful conservation will require an ability to assess the vulnerability of different species, habitats and landscapes to climate change, and to understand the specific factors putting them at risk. In the face of potentially large changes, and limited resources to respond, we will increasingly need new approaches that assess the relative vulnerability of habitats and ecosystems across large areas. The results of such vulnerability assessments will help identify where scarce conservation resources should be targeted.

The IPCC's vulnerability model of exposure, sensitivity and adaptive capacity provides a logical framework, but assessing vulnerability of the natural environment in practice is not straightforward. This is not just because of uncertainties about the scale and timing of climatic changes, but because there are still gaps in our knowledge about species and ecosystem processes and we do not yet have a full understanding of the specific factors that confer a high or low sensitivity or capacity to adapt, or what makes an ecosystem 'resilient'.

Despite these uncertainties, there is a need to explore practical methods to estimate relative vulnerability to inform our conservation efforts. We have begun to address this by developing and testing three different but related methods for assessing the relative vulnerability of natural environment features in three regions in England, covering a wide variety of habitat types.

In southeast England, we used a GIS grid model to input data, including habitat information and topography, and to undertake a spatial analysis at a $200m^2$ grid scale. Vulnerability is based on value (considering factors such as national or international conservation importance), sensitivity of different habitat types to climate change and adaptive capacity (including an assessment of the proximity of habitats to each other, the permeability of the surrounding landscape, topographic heterogeneity and of existing conservation measures currently in place).

In northwest England, we evaluated the vulnerability of the natural environment in each of the 29 National Character Areas (NCAs) in the region. The vulnerability of each NCA was scored using qualitative information about factors such as coastal location, elevation, topography, vegetation diversity, diversity of land cover and soils, and also using quantitative data such as percentage of open countryside, woodland and cultivated land. This enabled us to assign an overall score of high, medium or low vulnerability to each area.

In the West Midlands, vulnerability assessment is being done as part of a larger study to identify areas for potential habitat expansion. Vulnerability of possible new habitat areas was assessed using a grid square

approach, considering each habitat's sensitivity and adaptive capacity. These were integrated to show areas of high, medium and low vulnerability. The key benefit is to identify areas whose suitability for new habitat might be reduced by climate change.

While our findings do not provide a complete answer and should not be used to determine conservation priorities in isolation from other sources of information, we hope they will inform future conservation efforts and help identify areas for further attention and research.

Assessing the vulnerability to climate change of England's landscapes

NICHOLAS A. MACGREGOR, GEOFF DARCH, NIKKI VAN DIJK, LOUISA ASPDEN, SIMON BATES, CAROLINE BIRCHALL, IAN CROSHER, CLIVE DOARKS, COLIN HOLM, ANDY NEALE, CHARLOTTE REEVES, SARAH ROBINSON, LYDIA SPEAKMAN, SARAH TAYLOR & RICHARD WILSON

While landscapes and ecosystems are dynamic and have responded to changes in the past, the scale and pace of potential future climate change is likely to have significant implications for biodiversity and the wide range of benefits humans obtain from the environment (e.g. IPCC 2007). At the same time appropriate land management to preserve and enhance ecosystems can help buffer society from a changing climate (Morecroft & Cowan 2010). Appropriate adaptation action for the natural environment will therefore be essential.

Several sets of principles have been developed for adaptation (e.g. Hopkins et al. 2007; Smithers et al. 2008; Macgregor & Cowan, in press), which have an important role in guiding general approaches. However, adaptation is likely to be a very place-specific activity and the general principles need now to be applied and tailored to specific locations and different landscape and habitat types, to help develop detailed adaptation solutions for different areas.

National Character Areas (NCAs), 159 areas with that make up a well-established spatial framework across England, provide a useful geographic scale for research and action. They are large enough to enable us to consider large scale processes such as dispersal of species and movement of water, how people use and value an area, and the interactions between these things, but are also small and distinct enough (each having a well-described set of geological, biological and cultural characteristics) to enable us to explore the possible implications of climate change in specific different places.

We studied climate vulnerability and adaptation in 12 NCAs in different parts of England. The areas studied cover a wide range of landscapes, including upland areas, extensive and intensive farmland, chalk grassland, low lying wetlands, forest and heathland, coasts, urban fringe, and urban areas.

We developed an approach in which the overall landscape and the benefits it provides (encompassing biodiversity, landscape character, and ecosystem services) provides a framework for a more detailed assessment of assets such as flora and fauna, historic environment, geodiversity, natural resources, and places for human enjoyment and recreation. We used this approach to evaluate qualitatively the vulnerability to climate change of natural assets in the areas studied and consider how this collectively might affect the overall landscape and the benefits it provides. We also identified possible adaptation responses, focusing on actions that would maintain or enhance multiple benefits provided by a landscape by reducing vulnerability to a range of possible consequences of climate change.

We identified a wide range of potential vulnerabilities, from a range of climate pressures, such as drought affecting ancient woodland, saline intrusion into freshwater wetlands, warming weather driving species to higher altitudes. We also identified indirect effects, such as hotter summers affecting visitor numbers and in turn recreation infrastructure and habitats. We identified a range of adaptation responses, including many opportunities to achieve multiple benefits. Our findings are place-specific but some general

conclusions emerged for similar habitat types across the study areas. It is also apparent that action will be required at a range of geographic scales, from individual sites up to scales larger than the areas studied.

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Ecosystem-based conservation in a 4+ degree world

HUMPHREY Q.P. CRICK, NICHOLAS MACGREGOR & MIKE MORECROFT

Ecosystem-based conservation takes a broad landscape-scale approach to conservation and emphasises the services that the natural environment provides to society. The premise is that healthy, fully functioning ecosystems not only provide important benefits to people but also ensure the conservation of all the elements that make up those ecosystems (Sutherland 2004, MEA 2005).

A range of principles has been put forward to guide adaptation to climate change for conservation managers and policy-makers (e.g. Hopkins et al. 2007; Smithers et al. 2008). However, as we move into a +4° world, we will need to consider more radical solutions to help maintain biodiversity and ecosystem functioning.

We highlight three examples where different approaches might be needed in a +4° world compared to a +2° world.

Designated Sites: These provide high quality core conservation habitats for maintaining biodiversity. Current approaches to adaptation aim to improve site resilience by maintaining or enhancing habitat diversity and by reducing pressures from external factors. However, as we move towards a +4° world, bioclimatic zones may shift or an area become subject to a "non-analogous climate" - one with characteristics unrepresented within the current biogeographical region (Hossell et al. 2005). In such cases, the transition to a completely new ecosystem results in a "regime shift" (Anderson et al. 2009). The ecosystem approach to conservation can accommodate such changes, so long as the new systems are functioning in a "healthy" way (EASAC 2009).

Conservation Value: The conservation "value" of sites is currently assessed in terms of specific lists of species and habitats. The aim of conservation adaptation is to maintain and enhance species richness and maintain specific ecosystem services. A +4° world, with regime shifts and the formation of novel plant and animal communities, suggests that new approaches to measuring conservation value will be needed, such as Functional Diversity (Tilman et al. 1997; Petchey et al. 2004) and Phylogenetic Diversity (Faith 1992).

Connectivity and Permeability: Another key conservation strategy to aid adaptation to climate change is the creation of landscapes in which there are networks of habitat patches of high conservation value, connected by corridors or "stepping stones" of habitat that facilitate movement between patches (Hopkins et al. 2007, Vos et al. 2008). In addition, the "permeability" of the "matrix" surrounding these patches should also be improved to promote dispersal. Under a +4° world the wider countryside matrix will be under increasing anthropogenic pressure from a range of factors. Conservation may thus need to move to providing large, buffered areas of high ecosystem quality that, for some species, will provide sufficient opportunities for longer distance dispersal between these core ecosystem areas, as the intervening land becomes more hostile.

A +4° world is likely to emphasise the value of an ecosystem approach to conservation, and conservationists will have to develop new and more flexible approaches to conservation through their adaptation strategies. Given the long lead times often required for conservation planning at the landscape scale, we need to start thinking about these sorts of solutions now.

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Climate Change Adaptation Policy Assessment for Cascais Municipality – comparing the potential of Biodiversity measures with other sectoral adaptation measures

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Introduction

Current climate change can have severe effects on the natural environment, including agriculture, biodiversity, water resources and coastal areas (IPCC 2007; EEA 2008). Responses to climate change should include not only mitigation of greenhouse gas emissions, but also adaptation, which will be the only way to cope with the impacts that are inevitable over the next decades (Stern 2006). Successful adaptation measures enable communities to prepare for climate variability and climate change. Many studies assess impacts of climate change and identify adaptation options, but few consider adaptation options in the full context in which adaptation takes place, including the factors that determine the capacity of the region to adapt, such as local resources or stakeholder involvement. Biodiversity in particular is highly vulnerable to climate change but can also provide excellent opportunities to increase local and regional resilience to climate change through the design and implementation of well adjusted (green) adaptation measures. The Climate Change Adaptation Policy Assessment in Cascais Municipality (*PECAC Project)* identified the main potential impacts of Climate Change on the water resources, coastal areas, agriculture and biodiversity, assessed the most vulnerable areas and conducted a qualitative adaptation assessment that focused on the ranking and prioritization of identified potential adaptation options and measures.

Methods

Study Area

Cascais is a coastal Municipality located in Lisbon District, covering an area of just over 97 km^2. It is home to 183,000 residents and includes protected areas, such as the Cascais-Sintra natural park with its mountains and forests, beaches and dunes.

Impacts Assessment and Identification of Adaptation Options

The *PECAC Project* built socio-economic scenarios for the municipality by downscaling the A1(FI), A2, B1 and B2 Special Report Emission Scenarios (SRES) of the IPCC (2007). Climatic scenarios until 2100 were derived with downscaling techniques applied to the Global Circulation Model HadCM3 (PECAC 2010). Sectoral Impact Models were produced by analyzing future scenarios for water resources (WR), coastal areas (CA), agriculture (AGR) and biodiversity (BIO). The general approach was: 1) to establish a base case for each sector (i.e., present distribution or situation) researching available data; 2) to model the

present (control) situation in relation to climatic factors and 3) to generate future sectoral scenarios given the future climatic scenarios. Adaptation options were derived by the sectoral impact assessment teams using the results on potential impacts, literature review and stakeholder consultation.

Priority and Feasibility of Adaptation Options

A qualitative assessment of the adaptation options was carried out in a workshop with 12 experts and stakeholders (including representatives of the sectoral teams, experts working in several areas of CCIAV and one representative of Cascais municipality). They were firstly shown the expected climatic impacts and sectoral impacts in the different scenarios and considering no adaptation. They were then asked to prioritize the options using a Multi-criteria Analysis method. Options where ranked according to their: (i) importance; (ii) urgency; (iii) no-regret; (iv) co-benefits and (v) mitigation effects. Secondly, the technical, social and institutional complexity of the options was assessed and a complexity ranking developed (Bruin et al. 2009). For both the prioritization and the complexity ranking, each workshop attendee gave a score of 1-5 to each criterion (1-very low to 5-very high). Here we present the average results of that ranking (Bruin et al. 2009).

Results and Discussion

All future climatic scenarios forecast reduced rainfall and higher average temperatures across the municipality (decrease of about 10-32% in rainfall and rise in temperatures of 3.4 - 6.5°C by the end of the century). This will have a direct impact on water resources: a reduction of 20 to 50% in annual runoff is expected. The coastal areas (both sandy and rocky areas) will suffer a reduction due to sea level rise and changes in wave patterns. Beaches can be reduced by 10 to 50% until the end of the century, the ones facing southwards suffering the biggest reductions. The reduction in rocky shores will have a strong impact on the associated biodiversity (e.g. intertidal habitats and species) which is already fragmented. The Atlantic vegetation, very reliant on humidity, will disappear in the most severe scenarios. Mediterranean vegetation will be more resilient to climate change and some species may even benefit from it. The most vulnerable faunal groups include amphibians, reptiles and insects. In the marine environment, there will be more new fish species than lost fish species, in all future scenarios. A commercial opportunity for fisheries may arise since most of the new potential species are commercial species.

With these impact results, 58 adaptation options (of which 22 from the biodiversity sector) were listed. Within the top 15 options, 7 are Biodiversity options; the 2 options with the higher scores are Biodiversity options: “Implementation of the Cascais fire management plan” (4.5) and “Rehabilitation of streams and associated riparian vegetation” (4.03). Biodiversity options have in average the higher total scores. Biodiversity options also show the higher values in the no-regrets and co-benefits criteria and the second higher rank in mitigation (after agriculture). Options with lower complexity rankings were from the Agriculture and Biodiversity sectors. Within the 4 less complex adaptation options, 3 were from the biodiversity sector. Therefore, we can conclude that several adaptation options from the biodiversity sector seem to present high priority scores and low complexity of implementation, showing great potential for effective adaptation to climate change.

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Planning and Management Strategies of Nature Conservation in the Light of Climate Change

CHRISTIAN WILKE & STEFAN HEILAND

Climate change will seriously affect aims, strategies and instruments of nature conservation. This is caused by direct effects of changing climatic conditions on nature and landscape as well as by indirect effects which arise from societal measures to mitigate climate change and to adapt to it. Impacts will concern water, soil, flora and fauna but also the landscape as a whole as well as the scenery – and therefore aesthetical and recreational values of landscapes for humans. Although climate change has to be regarded as a global phenomenon, its characteristics can differ from region to region: Even if rising average temperatures occur globally, precipitation rates deviate strongly. Besides, predictions of precipitation rates as well as those for extreme weather events (rainstorms, hurricanes, droughts) are much more uncertain than temperature predictions.

The research project „Planning and Management Strategies of Nature Conservation in the Light of Climate Change“[1] discusses the question how nature conservation has to react to those changes and the uncertainties linked with them. Special attention has been paid to Landscape Planning as an area-covering planning instrument. As to nature conservation in general it can be said that there is no need to modify the aims of nature conservation as basically defined in the German Federal Nature Conservation Act. Rather it seems necessary to move the main focus from a ‚static' protection of species and biotopes to a more ‚dynamic' approach to protect and enhance the functioning of ecosystems as a whole. Therefore aspects which are especially relevant to or affected by climate change have increasingly to be taken into account, such as the services of ecosystems (woods, bogs), sinks or sources of greenhouse gases, landscape water regulation, flooding, soil erosion or human health in urban areas. Traditional aims and tasks in nature conservation have to be re-evaluated in the light of climate change.

Concepts like vulnerability and resilience, the ecosystem approach, adaptive management or risk management are often mentioned when planning solutions for the challenge of climate change are discussed. But a closer look at those concepts shows that their usefulness cannot be judged in general, because perceptions of them differ considerably (e.g. vulnerability, resilience, adaptive management), or because they were not especially developed for nature conservation and/or climate change (e.g. ecosystem approach, adaptive management, risk management). Particularly the ecosystem approach is too abstract to be used in concrete situations. Consequently, further research is essential for the application of those concepts in the practice of nature conservation and landscape planning.

Which requirements have to be fulfilled by landscape planning to cope with the effects of climate change? Firstly it has to counteract the negative impacts of climate change to nature conservation, and secondly to contribute to the societal adaptation to climate change and to climate protection (mitigation of

[1] The results of the project are published in German as: Wilke, C., Bachmann, J., Hage, G. & Heiland, S. (2011): Planungs- und Managementstrategien des Naturschutzes im Lichte des Klimawandels. Naturschutz und Biologische Vielfalt, Heft 109. Bonn-Bad Godesberg.

climate change). In order to fulfil these tasks landscape planning has to consider climate change and its impacts while dealing with all “traditional” subjects of protection. Above that new topics demand increasing attention, like climatic preconditions of human health or the storage of green-house gases in ecosystems. Besides new requirements concerning topics, the planning procedure itself has to be changed as the different uncertainties combined with climatic change do no longer allow the customary ‘deterministic’ planning approach. Therefore the planning procedure has to be suitable for the handling of uncertainties, for maintaining future options for decision-making and for flexible reactions to new knowledge or unforeseen developments. In addition to that the long-term positive effects of measures have to be ensured and synergies with other land uses have to be searched for (win-win-solutions). The necessary prerequisite to realize those aspects is a cyclic planning-process in which important stakeholders and experts are involved. Due to that scenario-techniques and monitoring are getting increasingly important.

Despite all this, special attention has to be paid to the fact that landscape planning must not be overloaded with new tasks. Therefore it is crucial to combine the different levels of landscape planning (from ‘Länder’-level to the level of municipalities) in a way which allows fulfilling all the requirements mentioned above together with the least possible additional expenditure. Therefore the regional level (Landschaftsrahmenplanung) should gain a central role, as it can clearly define the usually more abstract guidelines of the ‘Länder’-level (Landschaftsprogramm) on the one hand while providing a service-function for the municipal level on the other hand.

Practitioners will be especially interested in concrete answers to the question how they can consider climate change in the different working steps while a landscape plan is drawn up. Although it is not possible to give detailed answers suitable for every situation, some indications can be given. In the final report they are expressed as questions forming a kind of ‘check-list’.

Altogether a need for basic and practice-oriented further research and development remains. There is no sharp boundary between science and practice, rather a close cooperation between both sides seems necessary. The final report of the project offers a sound basis for such further consideration of climate change and its impacts on nature conservation and landscape planning in theory and practice.

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Towards a 'Good Change'? – Conceptual and ethical dimensions for integrating biodiversity protection and climate change adaptation

THOMAS POTTHAST & SILKE LACHNIT

Climate change has been identified as one of the major driving forces of biodiversity loss for the next decades. Hence, the goals and means of the Framework Convention on Climate Change (FCCC) and the Convention on Biological Diversity (CBD) will have to be integrated, also on national and European levels for maintaining and conveying biodiversity as well as for sustainable development under the conditions of climate change. The interrelations between nature conservation, protection of biodiversity, mitigation of and adaptation to climate change have to be clarified. Possible synergies as well as conflicts have already been identified (Paterson et al. 2008).

But not only empirical data, scenarios and practical methods have to contribute here. Concepts and ethical perspectives play an important role in adequately setting and enacting the agenda. Ultimately this will contribute to a realistic and feasible integration of climate change adaptation and nature conservation, not least with regard to the 2020 goals. One building block should be a justified concept of 'good change'.

Change as a Challenge

A long-standing general problem of conservation and its policies reads: why should we sustain or even restore a certain state of nature if it is constantly changing anyway? The last decades have spawned concepts of a more dynamic outline of biodiversity protection on all levels, from populations to ecosystems (cf. Botkin 1990). The conceptual shift from pattern to process, however, has not made clear whether processes themselves have become the new protection goal(s). It seems that often processes are understood mainly as means for maintaining those habitats and inhabitants that require ecological dynamics. In the latter sense, process is understood instrumentally. But in other cases, natural processes are conceived of ethically as goals in themselves with intrinsic value, hence becoming more important than e.g. specific species' or landscape protection goals. This tension remains unresolved and applies even more under the conditions of climate change. But should one give up the idea of maintaining specific species and habitats at all? That seems to be both grossly overstated as well as misleading and politically counterproductive. But some protection concepts, goals and goods will be challenged and - like it or not - have to be adjusted. All this does not preclude, however, the necessity of mitigation: Since major adverse effects on humans, ecosystems and biodiversity are to be expected, lowering the extent of anthropogenic contribution to climate change is well justified regardless whether nature changes anyway. In that sense, human action resulting in no or slow contribution to climate change is good.

Natural and Anthropogenic Change

Even a dynamic approach of protecting natural processes - as opposed to certain states with a fixed set of biodiversity elements - distinguishes between anthropogenic and natural change. This happens on both

the empirical and the valuation level. In the first instance the difficult empirical question arises whether or to which extent certain changes within ecosystems are caused naturally or by human action. On the normative level the question remains to justify why natural changes should generally be considered good whereas anthropogenic changes are less preferable. Concepts within conservation as well as of sustainable development have challenged the rigid evaluative supremacy of the 'natural' anyway: cultural landscapes, old local forms of cultivated plants and livestock within biodiversity protection and so on. Nevertheless, telling apart natural and anthropogenic change still remains to be one of the conceptual foundations of conservation, mainly because non-altered processes have become more and more scarce, with all ensuing effects on a large sector of biodiversity. But in the face of climate change effects, the separation between natural and human-driven change becomes even more blurred. Hence on the empirical level, 'wildness' as the idea of actual non-interfering gets detached from the notion of 'unaltered' nature. But ethically speaking, this does not at all inflict on the necessity to justify all human action (and forbearance) with regard to their effects on biodiversity and climate change. The challenge of adequately describing and valuing transformations in and of nature intensifies.

Good Change

In response to this situation, new approaches of environmental ethics and sustainability have to be developed to identify desirable changes. A normative concept of 'good change' requires the formulation of goals, criteria, and measures for biodiversity protection and promotion, which already include strategies of mitigation and adaptation. To meet these needs conservation even more has to focus not only on protected areas but on 100 percent of the land. But again, on the practical level this still would be in accord with some classical safeguard approaches protecting large areas as well as networks and corridors of habitats. The increasing speed and magnitude of natural and anthropogenic change will convey the need to establish new goods and goals beyond "to keep every cog and wheel (a)s the first precaution of intelligent tinkering", as Aldo Leopold (1970: 190) has once put it. As reasoned above, the notion of 'good change' still qualifies global climate change as an overall negative process to be halted or slowed down. But one should note that the often-mentioned example of intensive land-use for agro-fuels neither is good for biodiversity protection nor for a climate-sensitive sustainability.

Policy targets of present (sometimes naïve) conservationism have to be revised not least with regard to the concept of biodiversity framed by the CBD (cf. Potthast 2007). This includes the role of 'naturalness' as the main or only focal point for the derivation of values. The role of naturalness has to be reassessed as an important but not all-encompassing goal and criterion. Species and habitat changes should not be per se viewed negative in relation to earlier 'historical' benchmarking. The evaluation of biological invasions and 'alien' taxa has to be revised. At the same time, existing tendencies of uncritically welcoming all change will have to be put into question. Most notably, the targets need to be expanded with regard to human-nature interaction for sustainable development. On the other hand, processes as goals need at least some indication of the pathways and trajectories to be taken, notwithstanding that no fixed goals might be targeted. Nature conservation and sustainability do not overlap completely: the differentia specifica of the former lies in some sense of eudaimonistic (good life) and/or intrinsic value of biodiversity not to be covered completely by sustainability. 'Good change' shall thus integrate more encompassing notions of

sustainable development with perspectives on biodiversity reaching beyond ecosystem services and other functional approaches (for more details cf. Potthast & Lachnit 2010).

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Foundations and importance of ethical arguments in European NBSAPs

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Background

Communication about biodiversity needs convincing and reliable arguments. These must be based on solid ethical foundations. In a previous study[1] we suggested three types of arguments that in principle answer to the question „Why should an individual, an organisation or a nation commit to pursuing the aims of the CBD?“:

- Because it is in our own best interest – conservation and sustainable use of biodiversity as a matter of *prudence*.
- Because we love and value nature – conservation and sustainable use of biodiversity as a matter of the *good life*.
- Because we have an obligation to do so – conservation and sustainable use of biodiversity as a matter of *justice*, both towards humans living today and future generations.

Aims of our study

1. Comparison of several European NBSAPs concerning document types, structures, focal points and country specificities as well as analysis of their characteristics with regard to addressers and addressees.
2. Comparison and evaluation of arguments within European, German, Austrian and Swiss NBSAPs, focusing on the argumentative categories of prudence, justice and the good life.
3. Recommendations for the communication of these arguments with regard to a joint European effort to rescue biodiversity and guarantee its sustainable use.

National Strategies of D, A, and CH

To stimulate a trilateral dialogue, in March 2011, around 50 scientists and representatives of administrations, NGOs and public institutions from Germany, Switzerland and Austria met in Stuttgart-Hohenheim (Germany) for the „Dialogforum Ethik“ of the German Federal Agency of Nature Conservation. They discussed how communication and ethical reasoning of their countries‘ NBSAPs can be improved in their day-to-day work and in an European context. A documentation of the conference can be found on www.biologischevielfalt.de/10348.html (in German).

[1] Eser, U., Neureuther, A. & Müller, A. (2011): Klugheit, Glück, Gerechtigkeit. Ethische Argumentationslinien in der Nationalen Strategie zur biologischen Vielfalt. Naturschutz und Biologische Vielfalt. Heft 107. Bonn-Bad Godesberg.

A broad range of different European strategies

Rough comparison of 20 European National Biodiversity Strategies revealed a great heterogeneity with regard to most aspects analysed:

- Not all documents aiming at implementing the CBD are called a national strategy.
- Some strategies are very formal documents, others aim at broader public, most are intermediate.
- Geographical proximity is not related to the appearance and communication of a given strategy. Neighbouring countries often exhibit rather diverging takes in their respective NBSAPs.
- Although biodiversity conservation is a cross sectoral topic, basically Ministries of Environment have responsibility for biodiversity strategies. Thus, only few consider biodiversity in a broader development context.
- Depending on each country‘s specific features, all NBSAPs have different focal points: Topics linked with the conservation objective prevail in nearly all strategies, whereas sustainable use or Access and Benefit Sharing occur less often. Some documents overemphasis on one of the three CBD‘s goals.
- There is a great variety considering ethical reasoning and communication.
- While an explicit reference to ethics is rarely made, most countries implicitly build there arguments upon norms and values. It is very rare that a country dedicates a separate chapter to ethics.
- **In summary, most countries prioritize arguments of prudence, whilst references to justice and the good life are marginal.**

Further information

www.kowu.hfwu.de (in German)

http://www.hfwu.de/de/kowu/projekte/ethik-und-biodiversitaet-in-europa.html (in German)

www.biologischevielfalt.de/10348.html (in German)

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Climate change affects the economic and ecological value of savannah ecosystems

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The ecological and economic value of protected areas strongly depends on the dynamics of their goods and services, including diversity and abundance of plants and wildlife, genetic resources, water and fuel supply, recreation and tourism. For example, the protected area network in Namibia, constantly generates a significant economic value from the direct and indirect use of wildlife, tourism and wildlife industries (e.g. trophy hunting, harvesting of plants for fuel and medicine).

Namibia's fragile savannah ecosystems are facing increasingly unpredictable rainfall resulting in pronounced seasonal effects leading to degradation processes like desertification and bush encroachment and resulting land use conflicts. Therefore climate change does increase the vulnerability of these ecosystems. Management strategies for protected areas therefore need to consider potential and existing impacts of climate change.

One of the largest and most important protected areas in Africa is the Etosha National Park (ENP) in Namibia, originally proclaimed in 1907. Over the years, ENP was significantly reduced in size and completely fenced-in. Today, there are pronounced edge-effects and land-use conflicts alongside the park's borders. The fence has negatively influenced the ability of the ecosystem to adapt to climatic changes (e. g. wildlife migration), and the addition of artificial water holes has increased the incidence of anthrax in ENP. This artificial situation is a severe threat not only to the Etosha ecosystems and the park's wildlife but also to the adjacent areas, e.g. commercial and communal farmlands including conservancies.

In order to reduce the dramatic land use conflicts at the edges of the ENP we inaugurated the "Etosha buffer zone project" (Zeller and Göttert 2008), also to contribute to current initiatives of the Namibian Government to connect the ENP to the trans-boundary network of protected areas in Southern Africa. This project is designed as an interdisciplinary long-term monitoring project with the intention to establish buffer zones around the ENP. Thereby it is our intention to provide scientific data in order to maintain the ecological connectivity and to prevent further habitat degradation. Thus, our initiative and data will help to increase the resilience of this savannah ecosystem to cope with the potential impacts of climate change. Within the buffer zones we also consider the socio-economic aspect and the human use of natural resources under controlled conditions (ecosystem services). Thereby the project also benefits the local human populations and combines ecosystem functions with human livelihood.

Here, we present preliminary data from research on the biodiversity in selected areas at the borders of the ENP to demonstrate effects of climate change and human use in this semi-arid environment.

Seasonal effects on ranging behaviour of large herbivores, e.g. the black rhino (*Diceros bicornis*), clearly indicate the importance of a long term monitoring in order to validate wildlife management decisions, for example rhino-translocations, under the increasing influence of climate change.

To further evaluate the carrying capacity for the introduction of economical important wildlife into the ecosystems around the ENP we also use small mammals as bioindicators. Our data imply that small mammals can indicate disturbances and recovery of savannah ecosystems affected through grazing by wildlife and cattle. For example, *Gerbilliscus leucogaster* disappears in overgrazed areas. Other small mammal species are more sensitive to climate change. In 2006, we detected *Steatomys parvus* and *Dendromus melanotis* in Central Namibia which are supposed to be restricted to more northern regions following an increasing rainfall gradient. These findings indicate a change of climatic conditions and a consecutive change in species composition.

With our data we intend to provide reliable information for the development of management systems in order to sustainably use livestock and wildlife resources under the pressure of climate change and thereby contribute to establish socio-economic conditions which benefit human populations in Namibia.

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Annex 1: Programme of oral presentations

Tuesday, 12.04.2011

Opening

09.00 Welcome address and introduction
Prof. Dr. Beate Jessel & Dr. Horst Korn (BfN)

09.20 Helping Europe's wildlife and ecosystems adapt to a changing climate: some important research questions and the work of the ENCA network
Dr. Nicholas Macgregor (Natural England / ENCA)

Keynote presentation

09.40 Biodiversity and climate change: an overview of EU policies and some challenges and opportunities
Karin Zaunberger (European Commission)

Session I: Impacts of climate change on biodiversity

10.10 Assessing the fate of montane biodiversity in Europe under climate change: a novel approach using species distribution modelling and population genetics
Dr. Carsten Nowak (Biodiversity and Climate Research Centre)

Coffee / Tea (10.40 – 11.15)

11.15 Long term research of the Dogger Bank Epibenthos (North Sea): loss of biodiversity and changes in climate
Moritz Sonnewald (Biodiversity and Climate Research Centre)

11.45 Biodiversity in the (sub)arctic under different climate change scenarios
Dr. Anouschka Hof (Umeå University)

12.15 The Global Biodiversity Information Facility: Biodiversity data, data standards, access and tools to forecast climate change impacts on biodiversity
Dr. Nick King (Global Biodiversity Information Facility)

Buffet lunch (12.45 – 14.00)

Session II: Adapting nature conservation policies, strategies and measures to climate change

14.00 Ecological networks - an adaptation strategy for climate change?
Prof. Michael Reich (University of Hannover)

14:30 Climate change and the Natura 2000 network: assessments of species and habitat vulnerability
Mike Harley (AEA)

15:00 Adaptive management of climate-induced changes of habitat diversity in protected areas
Sven Rannow (Leibniz Institute of Ecological and Regional Development)

Coffee / Tea (15.30 - 16.00)

16:00 Forest conservation under a changing climate: adjusting concepts and policies in Germany
Mirjam Milad (University of Freiburg, Institute for Landscape Management) & Sabine Storch (University of Freiburg, Institute for Forest and Environmental Policy)

16:30 Climate change impacts on insects and their mitigation (CLIMIT project)
Prof. Josef Settele (Helmholtz Centre for Environmental Research)

17:00 Nature-based adaptation or adaptation-based nature?
Dr. Jan Plesnik (Agency for Nature Conservation and Landscape Protection of the Czech Republic)

17:30 Rethinking what is a 'native' and 'non-native' species as ranges shift as a result of climate change
PD Dr. Gian-Reto Walther (Swiss Federal Office for the Environment)

18:00 Poster session

Conference Buffet / Reception (18.30 – 20.00)

Special session on forecasting climate change impacts

20:00 Forecasting bird population changes in response to global warming using high resolution models: lessons learned from Germany
Dr. Thomas Gottschalk (Justus Liebig University Giessen / DDA)

20:30 An introduction to using the GBIF informatics infrastructure
Samy Gaiji (Global Biodiversity Information Facility)

Wednesday, 13.04.2011

Session III: Integrated and ecosystem-based approaches to climate change adaptation and mitigation

09.00 Possibilities and limitations for biodiversity conservation in a climate change adaptation framework under the UNFCCC
Eric Fee (German Federal Environment Agency)

09.30 ICI - The German International Climate Initiative, an innovative financing mechanism for protecting biodiversity and climate
Kerstin Lehmann (BfN) & Dr. Rudolf Specht (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)

10.10 Greening REDD+: challenges and opportunities for forest biodiversity conservation
Sabine Reinecke & Steffen Entenmann (University of Freiburg)

10.40 Carbon, biodiversity and ecosystem services: using maps to explore co-benefits from climate change mitigation
Dr. Monika Bertzky (UNEP-WCMC)

Coffee / Tea (11.00 – 11.30)

11.30 The West European Climate Corridor: an adaptation strategy for climate adaptation in the Rhine basin
Bram Vreugdenhil (Department of Environment and Land-use, Province of Gelderland, the Netherlands)

12.00 Achieving climate mitigation and adaptation without compromising nature: experiences from the CIPRA projects cc.alps and ecological networks
Aurelia Ullrich (CIPRA International)

Buffet lunch (12.30 – 13.30)

Session IV: Socio-economic aspects and integration with other sectors

13.30 Valuation of ecosystem services in Mediterranean forests
Dr. Elena Ojea (Basque Centre for Climate Change)

14.00 Vulnerability of Austrian mire habitats under climate change: implications for nature conservation and climate change mitigation
Dr. Franz Essl (Environment Agency Austria)

14.30 Paludiculture for biodiversity and climate: economics of rewetted peatlands
Achim Schäfer (University of Greifswald)

Coffee / Tea (15.30 – 16.00)

Panel Discussion

16.00 Discussion: priorities for research and conservation action and opportunities for enhanced cooperation

Panel of researchers, conservation practitioners and policy makers (Moderation: Prof. Dr. Beate Jessel, BfN)

17.00 Closing of Conference

Annex 2: Programme of poster presentations

1	***Monitoring and predicting 21st century biodiversity change: the impacts of global climate change*** **Presenter**: Dr. Cornelia Krug (DIVERSITAS)
2	***Spotlights on risks and policy options for Germany's protected areas under climate change*** **Authors**: S. Kreft, K. Vohland, F.-W. Badeck, K. Böhning-Gaese, W. Cramer, J. Hanspach, P.L. Ibisch, S. Klotz, I. Kühn & S. Trautmann **Presenter**: Stefan Kreft (Eberswalde University for Sustainable Development)
3	***How vulnerable are forest ecosystems against climate change? An exemplary index-based analysis for Lower Odra Valley National Park (Brandenburg, Germany)*** **Authors**: J. Blatt, B. Ellner, S. Kreft, L. Strixner, V. Luthardt & P.L. Ibisch **Presenter**: Stefan Kreft (Eberswalde University for Sustainable Development)
4	***Assessing the vulnerability of the terrestrial natural environment at a large scale*** **Authors**: N. A. Macgregor, S. Taylor, I. Crosher, Ch. Reeves, H. Q. P. Crick & M. D. Morecroft **Presenter**: Dr. Nicholas Macgregor (Natural England)
5	***Assessing the vulnerability to climate change of England's landscapes*** **Authors**: N. A. Macgregor, G. Darch, N. Van Dijk, L. Aspden, S. Bates, C. Birchall, I. Crosher, C. Doarks, C. Holm, A. Neale, Ch. Reeves, S. Robinson, L. Speakman & S. Taylor, R.Wilson **Presenter**: Dr. Nicholas Macgregor (Natural England)
6	***Projection of the butterfly diversity in Switzerland considering climatic changes until 2050*** **Authors**: F. Altermatt, M. Nobis & M. Plattner
7	***Got Climate? Current Vegetation Changes in the Alpine Region*** **Authors**: Ch. Bühler & K. Wunderle (Biodiversity Monitoring Switzerland Coordination Office KS-BDM)
8	***Climate response of endophytic pathogens of goatsbeard - linking plant pathology and ecology*** **Authors**: S. Ploch, & M. Thines **Presenter**: Dr. Julia Krohmer (Biodiversity and Climate Research Centre, BiK-F)
9	***Unexpected effects of pesticides under climate change conditions: Do we need new methods for ecotoxicological risk assessment?*** **Authors**: A. Seeland, R. Müller & J. Oehlmann **Presenter**: Dr. Julia Krohmer (Biodiversity and Climate Research Centre, BiK-F)

10	***Risk assessment and management of Riparian ecosystems in condition of Climate Change in Austria (RIPCLIMA)*** **Presenter**: Arpine Jenderedjian, Umweltbüro Klagenfurt
11	***The European INTERREG IVb project ForeStCliForeStClim: Transnational Forestry Management Strategies in Response to Regional Climate Change Impacts*** **Presenter**: Dr. Steffen Schobel (Research Institute for Forest Ecology and Forestry Rheinland-Pfalz, FAWF)
12	***Ecosystem-based conservation in a 4+ degree world*** **Presenter**: Dr. Nicholas Macgregor (Natural England)
13	***The Role of Urban Green Spaces for Cities under Climate Change*** **Authors**: I. Lehmann, S. Rößler, A. Bräuer, V. Goldberg & J. Mathey **Presenters**: Dr. Marco Neubert and Sven Rannow (Leibniz Institute of Ecological and Regional Development)
14	***Climate Change Adaptation Policy Assessment for Cascais Municipality – comparing the potential of Biodiversity measures with other sectoral adaptation measures*** **Authors**: M.J. Cruz, D. Avelar, T.C. Lourenço & J. Dinis **Presenter**: Maria João Cruz (University of Lisbon)
15	***Planning and management strategies of nature conservation*** **Presenter**: Dr. Christian Wilke (Technische Universität Berlin)
16	***Towards a 'Good Change'? Conceptual and ethical dimensions for integrating biodiversity protection and climate change adaptation*** **Authors**: T. Potthast & S. Lachnit (International Centre for Ethics in the Sciences and Humanities, Tübingen University)
17	***Foundations and importance of ethical arguments in subset European National Biodiversity Strategies and Action Plans*** **Presenters**: Dr. Markus Röhl and Hannah Seyfang (Nuertingen-Geislingen University)
18	***Climate change affects the economic and ecological value of savannah ecosystems - a challenge for the sustainable management of protected areas*** **Authors**: S. Starik, S. Bengsch, L. Mannetti, P. Dannenberg, T. Göttert, & U. Zeller **Presenter**: Nicole Starik (Humboldt-Universität zu Berlin)

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