Horst Korn, Jutta Stadler, Aletta Bonn,
Kathrin Bockmühl and Nicholas Macgregor (Eds.)

Proceedings of the European Conference „Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective“

Federal Agency for Nature Conservation

BfN-Skripten 367

2014

enca

Proceedings of the European Conference „Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective“

Bonn, Germany, 25-27 June 2013

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

Editors:
Horst Korn
Jutta Stadler
Aletta Bonn
Kathrin Bockmühl
Nicholas Macgregor

BfN

Federal Agency for Nature Conservation

Cover photo: Wetland (© A. Eglitis)
Wetlands are already affected by climate change in many parts of Europe. But conservation and restauration of wetlands are effective means for ecosystem based mitigation and adaptation while providing a range of co-benefits to society.

Editors' addresses:

Dr. Horst Korn
Jutta Stadler
Kathrin Bockmühl

Bundesamt für Naturschutz
INA Insel Vilm
18581 Lauterbach/Rügen, Germany
E-Mail: horst.korn@bfn-vilm.de
jutta.stadler@bfn-vilm.de
kathrin.bockmuehl@bfn-vilm.de

Aletta Bonn

Freie Universität Berlin
Berlin Brandenburg Institute of Advanced Biodiversity Research
Königin-Luise-Str.1-3, 14195 Berlin
E-Mail: aletta.bonn@fu-berlin.de

Nicholas Macgregor

Natural England, Hercules House
Hercules Road, London SE1 7DU
United Kingdom
E-Mail: nicholas.macgregor@naturalengland.org.uk

This publication is included in the literature database "***DNL-online***" (www.dnl-online.de)

BfN-Skripten are not available in book trade but can be downloaded in a pdf version from the internet at: http://www.bfn.de/0502_international.html?&no_cache=1

Publisher: Bundesamt für Naturschutz (BfN)
Federal Agency for Nature Conservation
Konstantinstrasse 110
53179 Bonn, Germany
URL: http://www.bfn.de

All rights reserved by BfN

The publisher takes no guarantee for correctness, details and completeness of statements and views in this report as well as no guarantee for respecting private rights of third parties.Views expressed in the papers published in this issue of BfN-Skripten are those of the authors and do not necessarily represent those of the publisher.

No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system without written permission from the copyright owner.

Printed by the printing office of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.

Printed on 100% recycled paper.

ISBN 978-3-89624-102-3

Bonn, Germany 2014

Contents

Preface

Biodiversity loss and climate change are among the most pressing challenges of our times, and they are strongly interconnected. Changing climatic conditions will both directly and indirectly impact on biodiversity but nature will also be part of the solution: ecosystems provide a range of services for society to adapt to and mitigate climate change. The recent major floods in Germany and parts of Europe in spring 2013 for example showcased the values and contributions of still intact or restored riparian ecosystems in significantly reducing flood wave peaks. Thus, next to concerted efforts to combat further climate change the need for strategies and measures to support adaptation of ecosystems as well as ecosystem-based approaches of societal adaptation is given.

Therefore, the German Federal Agency for Nature Conservation (BfN) in co-operation with the ENCA Climate Change Group and with support from the Free University of Berlin organized the conference on "Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective", which took place from the 25th -27th of June 2013 in Bonn, Germany. Following-up on the previous BfN/ENCA conference of 2011 on biodiversity and climate change, which aimed for exploring options on how to improve the dialogue between science, policy and practice, this year's conference highlighted the importance of adapting to climate change in nature conservation from an ecological, policy and economic perspective, and to showcase successful conservation partnerships across Europe in this respect.

In the name of the organising team, I would like to thank the speakers, poster authors, session chairs, and all participants for their excellent input, lively discussions and contributions in the interactive sessions.

The conference proceedings included in this volume are an attempt to reflect the richness of the presentations and discussions. The abstracts of oral presentations and posters provided by scientists and practitioners from all over Europe are complemented by a summary of the discussions, which took place in parallel sessions and in plenary. Based on these outcomes, the ENCA Climate Change Group elaborated conclusions on how to put principles of climate change adaptation into action during a workshop, which was held back-to-back to the conference. These recommendations were welcomed by the ENCA network at its 13th plenary meeting in Bonn and it was agreed to publish them on the ENCA website.

The conference outcomes and recommendations may serve European Nature Conservation Agencies, other sectors, Non-governmental organizations as well as applied science to further ecosystem-based adaptation activities - for the benefit of nature and society.

Prof. Dr. Beate Jessel

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

1 Introduction

The international conference “Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective” was held on 25 - 27 June 2013 in Bonn, Germany. It was organized by the German Federal Agency for Nature Conservation (BfN) in co-operation with the ENCA Climate Change Group and the Free University of Berlin.

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. Some of the latest scientific findings on the impacts of climate change on European ecosystems and their ecosystem services were presented, along with information about appropriate conservation measures. This was followed by interactive sessions focusing on i) specific requirements and solutions for different ecosystems and the species they support, ii) connecting with people and iii) adaptation planning. Finally, discussions considered current European policy and economic issues in climate change and nature conservation, leading to recommendations for climate change-adapted nature conservation in Europe.

Structure of the conference

The three day event, which was attended by 170 participants from 21 countries, comprised three main thematic sessions with presentations and time for questions and discussion, a poster session, eight parallel workshop sessions and a final panel discussion. Overall, 54 presentations were given in plenary and the interactive sessions, complemented by 30 posters which were displayed during the conference.

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 Climate Change Group, who warmly welcomed the participants and provided an overview of the scope and background of the conference. In the following keynote presentation Hartmut Grassl, former director of the Max Planck Institute for Meteorology, gave an excellent overview of observed and projected climatic changes at a global and European scale. The following first conference session focused on impacts of climate change, vulnerability and conservation tools and was opened by two keynote talks by Chris Thomas, University of York, and Katrin Böhning-Gaese, director of the Biodiversity and Climate Research Centre (BIK-F). These speakers focused on the impacts of climate change on biodiversity and nature conservation and provided insights into new data and modelling approaches to monitor and address climate change impacts. Further talks in the session addressed concepts of resilience (Mike Morecroft, Climate Change Natural England, UK), challenges of managing alien and endangered species (Gian-Reto Walther, Federal Office for the Environment, Switzerland), application of an ecosystem-based approach to adaptation (Timo Kaphengst, ecologic institute, Germany) and climate change adapted management of protected areas in Europe (Sven Rannow, HabitChange Project).

The second conference session focused on impacts of climate change on different ecosystems, with examples from montane, forest and woodland, grassland, peatland and urban ecosystems presented by Christian Körner (Universität Basel, Switzerland), Georg Winkel (Universität Freiburg, Germany), Andras Báldi (Centre for Ecological Research, Hungarian Academy of Sciences), Franziska Tanneberger (Universität Greifswald, Germany) and Ingo Kowarik (Technische Universität Berlin, Germany), respectively. This was followed by the presentation of the findings of an ENCA survey of conservation practitioners across

Europe on their perception on climate change and how they were responding by Aletta Bonn (Freie Universität Berlin, Germany).

On the evening of the first day there was a thought provoking keynote talk by Jacqueline McGlade (former Executive Director of the European Environment Agency, Denmark) in which she raised questions about how to address the ‘wicked’ problem of climate change in adaptation management and how citizen science approaches might help in contributing to monitoring change. This was followed by an evening reception hosted by BfN.

The second conference day was opened by a keynote by Micheal O’Briain, DG Environment, European Commission. Micheal O’Briain clearly outlined the challenges and opportunities of managing the Natura 2000 network in the face of a changing climate as well as changing EU policies and funding background. This was followed by a keynote talk by Klement Tockner (director of the Leibniz Institute of Freshwater Ecology, Germany), assessing research and conservation challenges of novel freshwater ecosystems in a changing climate. For the remainder of the day, the focus was on discussing and demonstrating good practice in adapting to climate change in conservation. This included eight parallel interactive workshop sessions with short input talks and group discussions, which are summarised below (section 4.4. to 4.11.), and a poster session at midday. The main messages from the workshops were presented in plenary in the afternoon and informal discussions and networking continued at the conference dinner that evening.

The third conference day was dedicated to addressing policy and business solutions for conservation under climate change. It started with a keynote talk by Rob Jongman (Alterra, The Netherlands), discussing the contribution of spatial planning of green infrastructure to adaptation management and links to EU policy. This was followed by a keynote talk by Volkmar Hartje, Technische Universität Berlin, presenting the first insights from the TEEB DE study on climate policy and nature conservation in Germany and emerging synergies and trade-offs of management approaches, in particular of mitigation measures and organic soil and biodiversity conservation. Further talks focused on options for payments for ecosystem services, especially safeguarding climate regulating services provided by peatland soils through restoration and financing through agri-environment schemes and emerging voluntary carbon markets (Mark Reed, University of Birmingham, UK). Cross-sectoral links and policy coherence were addressed by the last two presentations. The first discussed links between Nature Conservation and the Water Framework Directive (Michael Bender, GRÜNE LIGA e.V., Germany), and the second presented a case study on a forward-looking, evidence-based approach to spatial priority setting in Wales for adaptation and mitigation action using geographic information systems and participatory stakeholder involvement (Clive Walmsley, Countryside Council for Wales, UK).

The conference ended with a lively panel discussion on ways to develop a roadmap to put climate adaptation principles into action at the European, national and local level. The main points of the discussion are summarised below (section 3). In addition, a statement was given by Marina von Weissenberg as the IUCN Vice president which is presented in Annex 2.

This issue

This BfN-Skript presents the major outcomes of the conference with an overview of the discussions in the workshop sessions (section 2) and the plenary (section 3). The core of these proceedings form the abstracts of the oral and poster presentations which the majority of presenters have kindly contributed (section 4 and 5). Most authors have included their contact details as well as key literature and useful web links. Building on information presented in talks, posters, workshops and panel discussions during the conference, this volume also presents a set of conclusions and recommendations for putting the principles of climate change adaptation into action. These were developed by the ENCA Climate Change Group during a workshop after the conference and welcomed by the ENCA network at its 13th plenary meeting, which was held in Bonn, in October 2013 (Annex 1). In addition, the IUCN Vice president's contribution to the conference panel discussion is published in Annex 2.

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/0307_klima+M52087573ab0.html

2 Outcomes of the Conference Workshop Sessions

The interactive parallel sessions on the second day of the conference addressed nine specific themes. Six[1] of the sessions focused on the impacts of climate change on particular ecosystems and the adaptation measures for these, while two sessions addressed the cross-cutting issues of connecting with people and adaptation planning. Each session started with short input presentations, which were followed by interactive discussions in a world café style focusing on three main questions:

- What are the key challenges of a changing climate?
- How can adaptation principles be put into action?
  Which tools are most useful / needed?
- How can barriers to action be overcome?
  (knowledge / resources / institutional barriers)

The following sections capture the core of the discussions. Summaries of the session outcomes were provided by the session chairs with the support of rapporteurs.

2.1 Mountain and subarctic ecosystems

Introduction

Mountainous areas of Europe occur across a wide geographic range. They experience, and through their varied topography produce, a variety of environmental and microclimatic conditions, but a typical feature is climates that include 'harsher' and colder conditions than those found in many other European biomes, particularly in winter. This is also true of lowland subarctic areas of Europe, which were also considered in this workshop. Mountain and subarctic environments have relatively low species richness in comparison with some other biomes. However, they support important and unique species communities, including many endemic species. They also provide important ecosystem services.

Key challenges of a changing climate

It is commonly assumed that some of the strongest impacts of climate change could occur in these areas, because of both the projected global patterns of climate change and the strong effect that even small temperature changes could have in fragile montane, arctic and subalpine ecosystems. A temperature change that crosses the tipping point between 'frozen' and 'non-frozen' can have a strong impact on species. It could also trigger the release of large amounts of the greenhouse gas methane in the European subarctic through the melting of permafrost.

Overall, the picture is complex and uncertain. For example, there is greater certainty over potential changes in temperature than in wind and precipitation. Even for climatic changes that can be projected with relatively greater accuracy, the likely timing of changes and the exact effect they will have on biological communities is uncertain.

Despite the uncertainty about the future effects of climate change, a broad pattern that has been observed is the movement of different vegetation zones northward and poleward, as conditions at higher altitudes and latitudes become more suitable for species formerly limited by, for example, minimum temperatures. As this trend continues, it will bring in new species and lead to changes in inter-species competition within ecological communities. This is likely

[1] Grassland ecosystems and urban ecosystems were dealt with in one session.

to be to the detriment of current mountain/subalpine specialist species, which can often tolerate a much wider range of climatic conditions but are limited to their current ranges by competitive pressure at lower altitudes and latitudes (e.g. typically small, light-demanding vascular plant species which become overgrown by shrubs). In extreme cases, high isolated peaks could become islands on which alpine endemic species are trapped in ever-decreasing areas of suitable habitat/competition pressure. A key challenge for conservation, therefore, is to manage the potential isolation of peaks and loss of local endemism. More generally, conservation of species adapted to cold and moist conditions will be a priority. It will also be important to consider and conserve functionally important species – for example two of the talks in this conference session emphasised the importance of pollinators.

Recent advances in both field research and modelling of fine-scale environmental variation show that topographically varied landscapes create a huge variety of microclimates. This suggests that mountainous areas could enable species to find suitable new habitat without needing to move very far, and potentially also provide refuge for new species from lower altitudes. The conservation value of mountains could therefore be even greater under climate change, and there is a challenge to realize this potential through appropriate legislation and management.

Another major issue identified was that the challenge for mountain and subarctic ecosystems is not from climate change alone. While these areas typically have much lower human populations than lower altitudes/latitudes, pressure from human land use and associated issues such as nitrogen deposition are a growing problem. These pressures are likely to exacerbate and interact with the effects of climate change. For example, mining and associated development such as building of roads is increasing in the Russian arctic, with an impact that extends well beyond its physical ‘footprint’ on the ground. Activities such as this are likely to increase further as the climate warms and conditions become more favourable for mining and other development. Similarly, in some mountain areas climate change could allow more intensive agricultural activities to be carried out at higher altitudes leading to even more nitrogen deposition and increasing loss of species and habitat. Conversely, in some areas, changes to traditional farming practices and abandonment of land are a concern for conservationists, as some species depend on extensive traditional farming. The combined effect of climate change and land use pressure on species populations, ecosystem function and provision of some regulating ecosystem services is likely to be greater than the pressure of either factor in isolation.

Measures to put adaptation principles into action

A crucial step identified by the workshop participants was to ensure the protection of the most important locations (especially large and heterogeneous areas) in order to conserve vulnerable ecosystems and species. In line with this, appropriate networks of sites within and between key areas need to be put in place, to ensure appropriate core areas for species populations with movement pathways, escape routes etc. This would help to ensure that the archipelagos of mountains in Europe work to best effect in a warmer climate, realising their conservation potential and minimising climate-related risks to species. Assisted migration was suggested as something that would need to be considered in future for some species, to overcome the isolation of mountain peaks.
Further, where appropriate, traditional small-scale farming should be maintained (or restarted where abandoned), to conserve montane cultural landscapes and thus the species that depend on them.

Underpinning this, the group agreed that it would be essential to carry out a cross-European study to identify the species most at risk, their ecological requirements, current and possible future locations, and the extent to which management may increase their resilience to change.
Strategies for assessing climate change vulnerability and identifying adaptation options are necessary at a range of spatial scales, so that appropriate action is taken in each place but as part of a larger strategic plan. This should be done in a way that involves the participation of everyone with an interest – the involvement of people in effective adaptation solutions is essential.

Facilitating action and overcoming barriers

Legislative & institutional barriers

It was agreed that planning law should be based on a firm understanding of ecosystem function and the provision of ecosystem services. Appropriate legislation and spatial planning, based on the ecosystem/TEEB approaches, is likely to be needed to guide appropriate land use and exploitation.

At the local scale, extensive small-scale farming should be encouraged where appropriate.

In many cases, national boarders run through mountain and subarctic ecosystems. In order to ensure appropriate management of the whole of the Pyrenees, the whole of the Alps, the whole of Northern Lapland etc., constructive and effective cross-border coordination should be put in place.

Resources

It was suggested that currently too few funding opportunities exist for research and conservation projects in mountain and subarctic ecosystems. Governments, foundations and other funding bodies should provide more funding for projects in these regions.

Knowledge

We already know more than enough to start to take action. However, consistent and standardised long-term monitoring programmes, which are essential, are not yet in place or only just beginning and should be established and supported. Long-term monitoring data are a precondition to deliver useful data to IPBES. Examples are "The Long Term Ecological Research Network" (www.lter-europe.net) and the Global Mountain Biodiversity Assessment (http://gmba.unibas.ch). Additionally, there are several knowledge gaps that should be a priority for further research. These include:

- The assessment of priority species and geographic areas for conservation mentioned above
- Improving our understanding of how interacting biotic and abiotic factors influence species assemblages found in different montane, alpine and subarctic areas
- Assessing the likely effectiveness of refugia – in which places could species persist in the face of climate change making the surround area inhospitable, for how long are species likely to persist in these places, and are there thresholds in environmental conditions beyond which refugia no longer function?
- Understanding better how land use affects natural processes

Social barriers and public support

Successful conservation will require effective cooperation and communication with and education of local people, companies with an interest in these areas, and a much wider group of society that benefits from mountain and subarctic areas even if they live and work in completely different landscapes a long way away. Understanding and communicating the benefits that mountains and the subarctic provide for people will be essential; a wide range of communication activities could be used to deliver the required messages to different audiences. Two existing approaches provide useful tools to both communicate with and engage, enthuse and empower people and stakeholders. The first is the ecosystem approach of the Convention on Biological Diversity (CBD) as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way while recognizing that humans are an integral component of ecosystems; the second is approaches to valuing the natural environment, like for example in the TEEB studies[2]. A wide range of people from beyond the conservation sector should be involved in this. The media has an important part to play. Initiatives with local schools can also be very effective (for example the 'HabitChange' project in central Europe did this successfully). Knowledge should be produced and shared about best practice projects.

A key barrier to overcome is that mountain and subarctic areas might be seen by many in society as remote and 'worthless' terrain. Much more could be done to promote the benefits of ecosystem services such as slope stability (settlement and transport), water quality and options for summer grazing during lowland drought.

Conclusions

In summary, the session provided a large number of ideas and suggestions about the realization of adaptation measures in mountain and subarctic ecosystems. In order to put adaptation principles successfully into action and to overcome barriers, the workshop participants made the following recommendations:

- planning law should be based on a firm understanding of ecosystem function and the provision of ecosystem services
- constructive and effective cross-border coordination is needed
- governments, foundations etc. should provide more alternatives of funding for projects
- realisation of consistent monitoring programmes is important
- further research should be done to fill knowledge gaps
- extensive traditional land use practices can be used to conserve cultural landscapes
- large and heterogeneous areas are a high priority for protection
- cooperation with people and stakeholders through effective education, communication and engagement is vital

Session Chairs

Nicholas Macgregor
Natural England
Nobel House, 17 Smith Square
London
UK
nicholas.macgregor@naturalengland.org.uk

[2] The Economics of Ecosytems and Biodiversity, TEEB. See: http://www.teebweb.org/

Kathrin Bockmühl
Biodiversity Unit
German Federal Agency for Nature Conservation
Branch Office Isle of Vilm
18581 Putbus
Germany
kathrin.bockmuehl@bfn-vilm.de

Christian Körner
Institute of Botany, University of Basel
Schoenbeinstr. 6
CH-4056 Basel
ch.koerner@unibas.ch

2.2 Rivers, lakes and riparian ecosystems

Introduction

The session started with three complementary presentations on potential climate change impacts on the habitat availability of floodplain vegetation. The talks were a case study from the Rhine River, a valuation study of the floodplains along the River Elbe and a conceptual talk about helping nature adapt to climate change with best practice examples from Scotland. A very interactive debate followed these introductory presentations. It was clear from the beginning that the challenges, measures and actions to be taken are complex and interlinked. Throughout the discussion, it was stressed that climate adaptation and mitigation measures are equally important. There is a need to raise awareness of climate change and nature conservation, the potential consequences and the uncertainty of both changes and impacts.

Key challenges of a changing climate

The discussion focused on the main challenge, the uncertainty and potential impacts of climate change. It was stressed that climate change and loss or change of biodiversity are complex interlinked issues, understanding of these processes and awareness are lacking, and the dimensions of the problems go beyond the geographical, social and political scales within they are usually dealt with. The knowledge base and scientific evidence can also be differently interpreted. The key challenges can be summarised as follows:

- How to adapt to more frequent extreme rainfall and storm events, and consequently provide more room for living rivers?
- How to alleviate other pressures from different stakeholder interests resulting in excessive land use, grey infrastructure, flood protection, urbanization, navigation?
- How to deal with the uncertainty about what climatic changes will actually occur and how to adapt to this uncertainty?
- How to prevent or deal with climate mitigation measures from other sectors that may result in additional pressures (e.g. hydropower, biomass production)?
- How to raise awareness of stakeholders and the general public of the vulnerability of the different sectors related to river ecosystems and their floodplain?
- How to work across various administrative entities in different countries in river catchments.

Measures to put adaptation principles into action

The group agreed that the measures could be taken at different levels. Building better awareness, providing sufficient funding and working on long-term sustainable solutions are the basis for effective actions. Additionally, successfully putting in place adaptation actions requires identifying the right scale of implementation, involvement of local communities and long-term integrated catchment basin management planning, derived and implemented through stakeholder engagement (for example, workshops, meetings, participation). The group also stressed practical action at the local scale, particularly providing more space for living rivers as a key practical measure, in addition to providing more specific guidance for practitioners working in nature conservation, forming partnerships between nature conservation and other sectors and interest groups including a best practice approach. The legal basis for measures taken is provided by the Water Framework Directive and now needs implementation and concrete actions.

Overcoming barriers to action

The group felt that overcoming barriers should be undertaken simultaneously at different levels by sharing responsibilities and actions between governments and other stakeholders through participation and involvement as well as improving international/interregional cooperation and ensuring capacity building.

A clear rationale for action and identification of benefits at different (national, regional & community) levels were considered most important for providing a bigger picture, including evidence-based identification of risks and risk management planning. The key messages were to

- Provide more responsibilities and authority for river basin management authorities,
- Establish transboundary authorities and coherent, cross-sectoral European policy,
- Harmonise different stakeholder interests to promote more natural floodplain habitats and to act in a sustainable way.

Governance / stakeholder participation

All relevant stakeholders need to be identified from the very beginning and good governance at all levels of stakeholder participation has to be established to move from “top-down” governance structures to more integrated, collaborative and “bottom-up” approaches. A list of success stories can assist in ensuring implementation of a policy that is responsive to local situations and circumstances. To ensure integrated policy-making, different sectoral policies that are presently fragmented need to join up toward achieving multiple objectives and common aims. Governance should also include strengthening (creating) entities that deal with complete rivers and their catchments.

International, interregional and intersectoral cooperation

Importance should be placed on management at the river basin scale which often requires interregional co-operation, transboundary and cross-border management. Common goals and aims need to be defined, and supporting legal frameworks and administrative culture addressed. Ideally this should arrive at legally binding responsibility for river basin authorities. A priority is to link adjacent Natura 2000 areas across international borders.

Capacity building

Capacity building is also needed in administration. Scientific knowledge has to be translated into options for management action and the concept of ecosystem services and their (economic) value to society should be used to show the benefits of living rivers and healthy ecosystems. Particular focus should be placed on showing the risks and potential effects of climate change and how to deal with uncertainties.

Conclusions

The session discussed broader issues showing the complexity of the interaction between climate change and biodiversity in rivers, lakes and riparian ecosystems. Key recommendations were summarised in the following three messages:

- Create awareness among stakeholders when there is uncertainty about impacts from climate change as well as land use pressure; and balance the different interests to promote sustainable management for rivers, lakes and floodplains.

- Promote long-term integrated catchment management planning that is derived and implemented through stakeholder engagement (preferably face to face) to take forward adaption action.
- Give river basin authorities more responsibility and legal authority, and ensure transboundary collaboration and coherent, cross-sectoral European policy.

Session Chair

Gordana Beltram
Park Skocjanske jame, Slovenija
Skocjan 2, SI-6215 Skocjan
Slovenija

gordana.beltram@psj.gov.si/ www.park-skocjanske-jame.si

2.3 Grassland ecosystems

Key challenges of a changing climate

Grassland ecosystems in Europe cover an extremely broad range of land use, environmental and climatic gradients. Observed changes in the biodiversity and functionality of grasslands are a combined result of land use and climatic change, and these factors will continue to interact to cause further changes in the future. Overall, intensification and abandonment has strongly reduced the extent of high nature value grassland. Under climate change, wet, nutrient poor, and high altitude grasslands in particular are expected to be most affected. Key challenges to ensure resilience of grasslands under climate change include:

- a better understanding of changes in land use and climate,
- an improved knowledge of impacts of changes in land use and climate on soil carbon content, and
- the identification of the most vulnerable grassland ecosystem types.

Measures to put adaptation principles into action

In grassland ecosystems (as well as in other agricultural ecosystems) the design of agri-environmental schemes plays a crucial role for supporting climate change adaptation. There is an urgent need for a much stronger focus on the multifunctionality of Europe's agro-ecosystems. In the light of the latest outcomes of the negotiations on the EU Common Agricultural Policy (CAP) the group recommended:

- using the given flexibility to shift finances from the 1st to 2nd pillar and to assure adequate co-financing for measures undertaken under the 2nd pillar,
- focusing on outcome-oriented programmes and monitoring,
- shifting towards more flexible approaches (from "blue-prints" to adaptive approaches), and
- reducing subsidies for "bio-energy" crops.

Overcoming barriers to action

Several constraints for effectively adapting grassland ecosystems to climate change have been identified. These should be overcome by making use of the following activities:

- increase resources allocated in agri-environment schemes to grasslands,
- highlight the role of grasslands in climate change adaptation and mitigation (incl. soil carbon sequestration and storage, erosion prevention) by making explicit their multifunctional importance,
- and adapt guidelines to local contexts including translation of guiding documents,
- good practice examples for ecosystem-based adaptation to showcase multifunctionality and co-benefits of nature conservation projects should also be used.

Conclusions

The importance of biodiversity-rich grasslands for climate change adaptation and mitigation in agricultural landscapes is currently insufficiently appreciated. There is a strong need to streamline agri-environment schemes and land use policy towards a trajectory that provides resilience to climate change, building on multifunctional benefits and on a long-term perspective.

Session Chairs

Franz Essl
Environment Agency Austria
Spittelauer Lände 5
1090 Vienna
Austria
franz.essl@umweltbundesamt.at

Jutta Stadler
Biodiversity Unit
German Federal Agency for Nature Conservation
Branch Office Isle of Vilm
18581 Putbus
Germany
jutta.stadler@bfn-vilm.de

2.4 Urban ecosystems

Key challenges of a changing climate

The group identified and discussed several key impacts of a changing climate on urban areas. These include

- rising air temperatures (particularly extreme events like heat waves),
- changes in the water cycle leading to both water stress and extreme rainfall events and flooding,
- decrease in air quality, and
- biological responses to a changing climate (incl. spread of alien invasive species).
- Finally, a lack of areas which are not used for infrastructure and buildings makes adaptation planning in cities inherently difficult.

Measures to put adaptation principles into action

In order to enhance green infrastructure in urban areas, as an ecosystem-based approach for adaptation to climate change, the development, testing and application of participatory and bottom-up approaches are considered as critical. These include:

- urban biodiversity strategies with the involvement of all stakeholders,
- establishing advisory bodies for greening private and public investments,
- creating new partnerships and participation platforms, and
- strengthening the involvement of volunteers e.g. in community gardens.

In addition, the strong synergies with adaptation in other sectors (e.g. human health) need to be taken into account. Hence, the multifunctionality of urban green spaces needs to be stressed. The quality of urban green spaces in respect of their species composition should be enhanced e.g. by including more native plants and animals.

Overcoming barriers to action

Currently, the capacity to respond to key impacts on urban areas is often severely limited by societal, financial and technical constraints resulting from an underestimation of the importance of adapting cities ex ante to future climate change impacts. These include

- a lack of stakeholder involvement,
- a lack of awareness of the scale of future impacts on urban areas, and
- a lack of management skills of handling extreme events in city planning departments.

To overcome these barriers to action, the value and importance of public and private free spaces in cities must be made visible. Measures to do so include

- promoting best practice (e.g. a “best urban garden for climate change adaptation of the year” contest),
- creating legislative and financial incentives for climate change resilient urban planning, and
- making use of public-owned spaces to show how climate change adaptation in urban public spaces may be done best.

Conclusions

The participants stressed the importance of green urban infrastructure (gardens, wastelands, parks etc.) for climate change adaptation in urban areas. However, currently the contribution of urban ecosystems to climate change-adapted planning in cities is insufficiently appreciated. There is an urgent need to strengthen the recognition of green spaces in urban planning.

Session Chairs

Franz Essl
Environment Agency Austria
Spittelauer Lände 5
1090 Vienna
Austria
franz.essl@umweltbundesamt.at

Jutta Stadler
Biodiversity Unit
German Federal Agency for Nature Conservation
Branch Office Isle of Vilm
18581 Putbus
Germany
jutta.stadler@bfn-vilm.de

2.5 Coastal & marine ecosystems

Key challenges of a changing climate

The discussion revolved around the most crucial challenges: sea level rise and loss of intertidal and coastal ecosystems (particularly when 'squeezed' against human infrastructure), as well as impacts on human communities in coastal areas; and shifts in the ranges of species. It was noted that climate change effects are difficult to tease out from the effects of other pressures and the lack of historical data makes research on climate change impact on marine ecosystems challenging.

Uncertainty in scientific knowledge also has resulted in the fact that current legislative frameworks do not sufficiently embrace climate change impacts or adaptation responses.

Measures to put adaptation principles into action

This group focused on fairly pragmatic approaches and tools to put adaptation into practice. It was emphasized that it is important to establish participatory processes to define common adaptation objectives. Here citizen science projects were specifically mentioned. Maritime Spatial Planning (MSP) as well as Integrated Coastal Zone Management (ICZM) were considered to be important tools that allow integration over various economic sectors and engage the stakeholders through participatory processes. It was emphasized that any planning processes in the marine environment should be carried out also across national borders by transboundary marine spatial planning.

Overcoming barriers to action

As a starting point it was considered that conservation and protection of the marine and coastal environments in the face of climate change require solutions that allow win-win situations, consensus, common ground and equitable sharing of benefits, in terms of both economic and social benefits. Communication was considered highly important and this was thought to apply not only to the setting of objectives, but also to platforms for discussions and negotiations at an international level, such as regional marine conventions. In addition, it was emphasized that communication should embrace catchments, coasts as well as marine areas. Ensuring that project outcomes are maintained once the projects are finished was also deemed important. This could be ensured by economic and social benefits that are derived through implementing and sustaining project activities. It was also pointed out that EU policies should not be conflict with each other. (For example, promoting biofuel production may conflict with the objectives of marine conservation as a result of eutrophication from fertilizer use at the biofuel production sites.)

Conclusions

The session provided a long list of pragmatic recommendations. Planning and management tools (MSP and ICZM) as well as communication and participatory approaches ended among the most important recommended activities.

Session Chair

Maria Laamanen
Baltic Sea Marine Environment Protection Commission, HELCOM
Katajanokanlaituri 6 B
00160 Helsinki
Finland
maria.laamanen@helcom.fi

2.6 Forests & woodland ecosystems

Introduction

Forests and woodland ecosystems in Europe have been shaped by climatic changes of the past as well as land use and conservation management. This was highlighted in the lively and well attended discussion. Both existing challenges and new ways of integrating environmentally-friendly policies in the forest sector (e.g. at the landscape level) were considered, along with ways to make better use of existing tools and adaptation principles. The importance of raising awareness and building new partnerships from the local to regional and global levels was also highlighted. Additionally, the fact that biodiversity in forest areas is significant in Europe also raised the issue of responsibilities of different actors, appropriate timing and measures as well as the question of added impact of climatic changes to conservation.

Key challenges of a changing climate

In Europe the multiple potential services and beneficiaries of these services derived from forest and woodland ecosystems have not yet been fully evaluated. Forest biodiversity is affected by the volume and common practices of commercial forestry as well as by the conservation and restoration efforts carried out by the state and, to some degree, forest companies and private forest owners. Challenges include: the risk of introduced species, the length of time required for forest regeneration, and the uncertainty of scientific knowledge of climate change impacts. Potential conflicts between different forest users under climate change were also mentioned: for example, models might project an area to become unsuitable for commercial production of a particular tree species, leading to pressure from industry for major logging and replanting even if there is a possibility that the species might persist in smaller numbers and continue to play a useful ecological role for some time to come. It was noted that climate change arguments have already been used to challenge traditional management practices and new recommendations have been made. It was mentioned that there is a general lack of national level adaptation strategies for forests. Current legislative frameworks do not include climate change impacts or adaptation aspects in all countries.

Measures to put adaptation principles into action

The group considered different ways and means for preserving old growth forests and ecologically valuable forests habitats, and for understanding the trade-offs and long-term requirements for adaptive management, including monitoring. Good planning and sustainable forest management (SFM) was considered important. Society's role and interest including the need for valuation (applied with caution and based on sound scientific evidence) was mentioned. The TEEB (The Economics of Ecosystems and Biodiversity www.teebweb.org) process was mentioned as important for making valuation work nationally and as a way of considering synergies and trade-offs of management actions for biodiversity and societal benefits. The role of EU policies and implementation needs of existing policies and legal frameworks was considered important for making an adaptive regime work. It was emphasized that communication and sharing of knowledge is crucial in a changing world.

Overcoming barriers to action

In order to overcome existing obstacles, the group concluded that it is crucial to engage different stakeholders in a communication process from the beginning. We need to raise awareness of benefits and potential risks of climate change for biodiversity conservation and society. For this we need to employ different participation tools and mechanisms and work with forest owners and civil society. The consideration of incentive measures and appropriate planning tools and monitoring mechanisms at the landscape scale (e.g. High Value Areas) were also discussed. Forests on state land were highlighted as potential 'monitoring design areas' where scientific evidence could be gathered and new management approaches tested.

Conclusions

The well attended session provided a list of recommendations for the way forward. Forest and woodlands ecosystem remain important habitats in a changing climate. The impacts of climate change need to be carefully monitored, particularly in areas subject to commercial forestry (which itself could change in response to climate change, for example by increasing the harvesting of energy wood, or changing current management activities). Forest owners and stakeholders need to be included in discussions about the enabling environment and the design of monitoring schemes, so that they can be easily implemented. Forest areas also have cultural and recreational value to many members of society, who need to be involved in discussions about the future management of these areas. Therefore, communication and participatory approaches will be an important aspect of developing adaptation strategies.

Session Chair

Marina von Weissenberg
Ministry of the Environment
Kasarmikatu 25
Helsinki, FI-00023 GOVERNMENT
Finland
Marina.vonweissenberg@ymparisto.fi / www.environment.fi

2.7 Peatland ecosystems

Introduction

Many peatland ecosystems are damaged. In Europe, conversion to agricultural land and forestry has been the main driver of peatland degradation, although in some places peat extraction is causing local damage to peatland sites. For example, in the Koni Republic, Russian Federation, 100,000 ha of peatlands have been drained for agriculture although all of this is now abandoned. We see a similar picture throughout Russia with estimates of over 6 million ha of damaged peatland. Conditions of drought, possibly as a result of climate change, are exacerbated through wild-fires that also create dangerous haze. The fragility of damaged peatland sites can be reduced through hydrological restoration that enhances wildlife populations (for example, the aquatic warbler *Acrocephalus paludicola* in the Biebrza Marshes in Poland) or paludiculture (for example in Mecklenburg-Vorpommern, Germany) for products that grow on wet soils such as reed for biofuel.

Discussions in this session considered both peatlands in Europe and some international peatland issues related to EU policies.

Key challenges of a changing climate

The fragility of damaged bogs is exacerbated by climate change where higher temperatures and changing precipitation patterns causes further hydrological instability. Additional issues are that:

- continental peatlands are particuarly susceptible to drought and wildfire
- buffer areas become drier
- there is additional pressure to develop peatland areas for agriculture
- damaged bogs become more difficult to restore under changed climates and more difficult to plan management for given an uncertain future
- peatlands at the edge of their range are more susceptible to damage

In particular, climate change is also driving a renewables industry that can have damaging impacts on already damaged and still natural (‘not-damaged’) peatlands both in Europe and overseas.

Two examples are pertinent:

In the United Kingdom, there are government subsidies designed to encourage renewable energy technologies such as wind-power. The windiest places in the UK are in the uplands, areas that are also often dominated by blanket bog habitat. Developers argue that the carbon benefits of wind-powered energy outweigh the loss of carbon within the peat as a result of wind-turbine development. However, these calculations rarely take into account the wider damage to the peatland ecosystem due to the hydrological disruption resulting from peat removal and access roads. Furthermore, conservationists would argue that it is illogical to destroy carbon stores to reduce carbon emissions – all tools to mitigate for the build-up of carbon in the atmosphere that are available should be used, including the conservation of soil carbon and wind energy (on non-peatland areas).

Likewise, the European biofuel subsidy is driving conversion of tropical peatland forest to palm-oil plantations. This represents perhaps the greatest environmental calamity of recent decades with a rapid conversion of the last large areas of tropical forest to agricultural land in SE Asia, and the destruction of an immense carbon store.

Measures to put adaptation principles into action

The group discussion highlighted a range of measures:

- Incentives for adaptation and awareness building
- Creating an enabling regulatory environment, for example, by providing incentives for reed cutting, stimulating ecotourism, creating markets for paludiculture and bio-energy crops
- Linking mitigation measures to adaptation, for example, peatland restoration financed via mitigation but designed to enable peatland species and habitats to adapt to climate change, or protecting pristine peatlands from drainage
- Funding for adaptation options, for example, agri-environment schemes, private payment for ecosystem services schemes, markets for new agricultural outputs (e.g. bioenergy crops)

In particular, the group felt one of the more important measures was to create market-based incentives for peatland restoration and to promote the benefits of these markets to policy makers, purchasers of ecosystem services and the general public.

A policy response is required that both removes perversities in Government's policies to mitigate for climate change and creates new markets. Energy subsidies to encourage renewable energy sources can have unintended consequences by exacerbating emissions through the destruction of soil carbon stores. This represents a market failure to monetise valuable ecosystem services such as carbon storage. As a result, while tropical peatlands perform a manifest and globally valuable ecosystem service to store soil carbon (and protect coastal communities from flooding in many areas, while also supporting nature tourism), these services procure little monetary benefit to owners (or forestry rights holders). Conversion to oil palm provides monetary benefit both from the value of timber and from oil palm production and is partly promoted by European biofuel policy. An alternative is to develop market-based incentives to enable the monetisation of these ecosystem services and hence provide alternative income streams to owners and rights-holders.

The announcement from the Indonesian Government, in late 2012, that it had approved its first REDD+ project (reduced emissions from deforestation and forest degradation) designed to protect 80,000 ha of peatland forest in Central Kalimantan from oil palm conversion, is thus highly significant. Likewise, the Mecklenburg-Vorpommern Regional Government has set up a strategy to attract corporate and private investors by offering "MoorFutures" (carbon credits via the voluntary carbon market www.moorfutures.de) to restore wetlands in northern Germany.

Overcoming barriers to action

The group noted these barriers and looked at what actions could be taken to overcome the challenges. Priorities identified in the workshop include engaging decision makers with thinking from the general public and NGOs, and better research into the value of ecosystem services and how taxation/subsidy can be used to reflect that value were seen as important. The group noted that adaptation actions can also be mitigation actions for peatlands given their role in both storing carbon and sequestering carbon from the atmosphere.

A particular issue is to move away from a land subsidy for farming on peatlands to one which pays for the delivery of ecosystem services and public benefits.

One of the more important policy drivers for peatland degradation or restoration is the Common Agricultural Policy (CAP) of the European Union. National application of the CAP can be extremely damaging with, for example, widespread drainage of peatlands in the United Kingdom during the 1970s and 1980s as a result of CAP payments for land drainage. However, currently UK policy is to pay farmers to block drainage ditches on upland peatland sites, leading to restoration. Recent CAP negotiations have led to few reforms of the current land subsidy system in the European Union. Payments are still fundamentally bound to agricultural production rather than for a land subsidy to pay for the delivery of public benefits and ecosystem services that cannot be supported by the market (i.e. state support to address a market failure). This is disappointing but there is latitude within the subsidy arrangements of the European Union, in which national Governments have considerable room to deploy more locally-tailored policy solutions to European Union policy.

Conclusions

It is interesting that European biofuel policy is partly responsible for the transboundary haze across SE Asia, in which smoke from damaged and drained peat-swamp fires in Borneo and Sumatra are reducing visibility and causing significant health problems in many SE Asian cities (despite many being thousands of kilometres from the fires). This provides a dramatic illustration of the hazards to society consequent on climate change and how European policy affects peatlands everywhere. Peatlands are relatively robust systems and have adapted well to climate change in past millennia but once damaged are very fragile. It is ironic that Government policies that are explicitly or in part designed to mitigate climate change (such as Europe's biofuel policy or its Common Agricultural Policy) can have the perverse effect of damaging these rich soil carbon stores across the world. However, new policy instruments and more sophisticated application of policy and financial instruments can be used to address ecosystem service provision market failures. It is not too late to conserve the world's remaining peatland carbon stores.

Session Chair

Rob Stoneman
Yorkshire Wildlife Trust
1, St Georges, Place
YO24 1GN
England
rob.stoneman@ywt.org.uk

2.8 Connecting with people – why biodiversity conservation makes sense in a changing climate

Introduction

Despite the importance of the natural environment to society, public understanding and awareness about the importance of biodiversity and its role for climate change adaptation and mitigation is often very low or even non-existent. This interactive session discussed how it is possible:

- to overcome this lack of awareness
- to foster a better understanding about the issue
- to develop a more positive perception towards biodiversity, ecosystems, mitigation and adaptation approaches
- to gather more support for conservation
- and to achieve a greater level of investment in conservation

Key challenges of a changing climate

The starting points of the discussion were the complexity of climatic and biological processes as well as the uncertainty of climate change effects on biodiversity and the resulting communication challenge. The group also noted that the main challenge is possibly not only the complexity and uncertainty itself, but rather overcoming and changing our (western) lifestyle, which is often disconnected from nature and very resource-intensive. For this reason, the group concluded that societal change needs to be promoted through communication and awareness-raising in order to reconnect to nature by adapting our lifestyles and values. To address such changes it was suggested that we should use all types of supporting arguments, such as for instance inter- and intra-generational justice or the pursuit of a "good life". The following main messages, among others, were discussed and developed by the group:

- the links and interaction between climate change and biodiversity are complex and uncertain
- there are major structural changes of society and our economic system needed
- we need to reconnect to nature by changing lifestyles and values
- measures must be taken to put adaptation principles into action

The group agreed that it is of particular importance to create spaces and formats for everyone to experience and understand biodiversity and the impact of climate change in order to increase awareness and promote behavioural change through education and knowledge sharing. The goal should be to recognize that humans are part of nature and depend and impact on it. For the purpose of establishing nature conservation as a cross-cutting theme in society and the economy, the following communication, education and public awareness instruments and approaches were proposed by the group:

- interactive workshops (to promote two-way communication)
- citizen science projects (e.g. to identify local scenarios)
- platforms for knowledge exchange and to involve people
- using flagship species for communication
- promoting positive examples of conservation

Overcoming barriers to action

In order to overcome existing obstacles in communication and to connect with the wider public, the group concluded that it is crucial to engage all stakeholders in a modern ("21st century") orientated two-way communication process. This should particularly involve finding a common language, agreeing on shared values and demonstrating the benefits of biodiversity conservation for climate change adaptation. In order to do this, the following aspects were suggested:

- find a common and clear language for each appropriate level and geographical scale required
- ask questions and listen actively ("do not assume you know it all already")
- clarify and demonstrate relevance of conservation for each specific stakeholder group
- highlight costs / benefits and conflicts of interests at a local level
- connect issue to people's values and moral intuition (e.g. to inspire)
- create institutional synergies: national, transnational, sectoral, horizontal and vertical

Conclusions

To strengthen awareness of the value of biodiversity conservation and its linkages with climate change mitigation and adaptation, communication and key messages need to capture the hearts and minds of the public, decision-makers, scientists and business leaders alike. Communication about conservation and climate change must not be overly complex and scientific, it rather needs to be connected to our everyday lives and be integrated into our daily decisions in order to facilitate a change of lifestyle.

Session Chairs

Klemens Riha and Gesa Dodt
GIZ
Godesberger Allee 119
Bonn, 53175
Germany
klemens.riha@giz.de; gesa.dodt@giz.de

2.9 Adaptation Planning – How can we plan for change?

Key challenges of a changing climate

Due to the cross-cutting character of the topic, the participants stressed that within climate change adaptation planning, other land-use should also be taken into account, preferably within multifunctional spatial planning. Because there is a general lack of suitable data to be used in a reasonable way during adaptation planning procedures, establishing and maintaining long-term monitoring schemes is needed. At the same time, risks and opportunities should be well defined to enable to specify goals, which minimize risks and maximize opportunities. The group particularly mentioned that ecosystem-based climate change policy as well as management measures in the field should be implemented in a flexible way ('adaptive management') that is adapted to local circumstances. It was also highlighted, that due to lack of time, finances, staffs and other capacities, actions for climate change adaptation should be carefully evaluated and prioritized.

Measures to put adaptation principles into action

After the debate, the group concluded that for implementation of sound climate change adaptation principles, we need good monitoring, robust data and reliable models. Collection of best practices as well as failures with examples from a broad range of natural, political, social and economic conditions would be appreciated both by decision-makers and practitioners. Successful adaptation planning is not possible without deep involvement of stakeholders, partners and the wider society (a participatory approach). This approach implies communication, education and public awareness in this field are significantly and rapidly improved.

Overcoming barriers to action

The group started with the fact that, as mentioned above, long-term ecological monitoring should be improved and the knowledge should be shared with the appropriate stakeholders and partners. It is clear that nature conservation thinking and paradigms should move from the efforts to conserve the past to forward-looking measures at the species, ecosystem and landscape level. This can be carried out by, inter alia, inter-sectoral approaches to landscape management implemented by professional and voluntary conservationists, researchers, planners, developers, farmers, foresters, decision-makers, and others. Ideally, climate change adaptation planning should be supported by an appropriate legal framework, with sufficient resources allocated to implement it effectively.

Conclusions

The session provided many remarkable ideas, stressing a logical chain of an adaptive ecosystem approach based on long-term effective collaboration with as many stakeholders and partners as possible, and building on this for conservation thinking.

Session Chair

Jan Plesnik
Nature Conservation Agency of the Czech Republic
Kaplanova 1931/1
CZ-148 00 Praha 11-Chodov
Czech Republic
jan.plesnik@nature.cz, plesnik.jan@seznam.cz / www.nature.cz

3 Conference Plenum Discussion Summary

The final plenum discussion focused on developing a roadmap to put principles into action. The panel was chaired by Beate Jessel, BfN, and panellists included Rob Jongman, Alterra, Wageningen; Nicholas Macgregor, Natural England / ENCA; Micheal O'Briain, European Commission; Chris Thomas, University of York; and Marina von Weissenberg, International Union for the Conservation of Nature (IUCN). Here we summarise the main points.

The big challenge for the roadmap is to move beyond accepted principles for climate adaptation (Bouwma et al. 2012[1]) and put these into action. A host of management initiatives are already underway, and there is an urgent need to examine in more detail how adaptation is put into practice, to compare contrasting instruments and methods and to assess what measures work in different situations to develop good practice.

Furthermore active communication is needed to involve and listen to practitioners and share good practice, improve knowledge exchange and collaboration to work across wider networks of European countries, organisations and conservation areas.

It was stressed that integrated conservation management must include a focus on nature-based solutions to climate change adaptation through an ecosystem-based approach (see also IUCN statement, Annex 2). While this concept may already be accepted in conservation circles, the mainstreaming of the EbA approach needs to be enhanced with stakeholders to raise understanding how this can lead to protecting and enhancing natural infrastructure. Networks between administrations, NGOs, policy advisors, business and science need to be promoted.

Overall, it will be necessary to strengthen the science-policy interface. This could be improved by bringing together a European-scale assessment of species and ecosystem services in a changing climate and identifying opportunities and risks for adaptation management in conservation. Research is also needed to identify climate change refugia locations across Europe for species and ensure good land management (including formal protection where appropriate) for 'future-proofing' of these areas. Simultaneously, scientists also need to clearly communicate climate impacts and their uncertainties and translate this information to local levels for conservation managers to act upon.

Climate adaptation thinking needs to be fully embedded into nature conservation. For example it could be useful to enhance the Habitats Directive reporting to include climate change measures. Conservation management may need to accept change and broaden its scope from species-focused approaches to consideration of structural and functional integrity of sites. While traditional approaches should not be thrown overboard, conservation may need to move from a 'preservation' mode to a focus that accommodates and where necessary facilitates change in species composition and movement. Connectivity across landscapes should in general be improved, though caution may be required to assess when increasing connectivity might not be useful or indeed harmful. Conservation within protected areas and other conservation sites may need to address identification of potential refugia ('cold spots') or implement changes in management to assist species that are particularly vulnerable to climate change.

[1] See: http://ec.europa.eu/environment/nature/climatechange/pdf/N2_CC_guidelines.pdf

In a changing finance regime, it may be necessary to look for innovative partnerships for funding and to use the potential of climate-related EU funding for conservation, including through agri-environment schemes. It was stressed by participants in the audience that the multi-functional benefits of nature and climate adaptation to society need to be better communicated. The TEEB approach was seen as a promising concept to aid the translation of conservation values to leaders and decision makers, and to assess synergies and trade-offs of management and policy options. This may also help to work across agendas and link biodiversity with other issues, such as human health, in a changing climate.

Biodiversity conservation will need to work within existing legislation, and land use conflicts are likely to increase with a changing climate, including because of mitigation action by other sectors, such as promotion of biofuels. Here, clear priority-setting and spatial planning of green infrastructure may help to alleviate conflicts. In this respect the EU parliament may become an important player. It will also be necessary to involve more people from the Mediterranean to work towards Pan-European connectivity, though experts in these countries are often stretched for time and resources and may find it difficult to collaborate as a result.

Overall, the consensus was that conservation cannot wait to act, and that adaptive management needs to be understood as an ongoing process to be refined through cross-sectoral collaboration and incorporation of new evidence as it becomes available.

Please note: Based on the conference presentations, workshop session outcomes and plenary discussions the ENCA Climate Change Group developed recommendations at a follow-on workshop to this conference which are presented in Annex 1 of these proceedings.

4 Abstracts of Oral Presentations

4.2 Opening address

Nature conservation and climate change – a brief overview on recent BfN activities

Beate Jessel
German Federal Agency for Nature Conservation (BfN)

1 Introduction

Biodiversity loss and climate change are among the most serious challenges humans face in the 21st century. Effects of climate change on biodiversity and society (negative, positive and neutral ones) can already be experienced throughout Europe. One example giving evidence of the probably already existing influence of climate change have been the big flood events we recently had here in south and eastern Germany within the last weeks, and which did also affect parts of Austria and the Czech Republic. Therefore, in order to lessen negative impacts adaptation measures are needed which are scheduled not only in the short but in the long term. To support the adaptation of nature to a changing climate, specific solutions for different ecosystem-types as well as strategies and policies for cross-cutting issues (e.g. the establishment of green infrastructure to enable better evasive movements of species) ought to be sought. Also, the important role of nature and nature conservation for societal adaptation should be promoted since this can be a cost–effective alternative or supplementary strategy to technical adaptation measures.

But next to direct climate change effects, indirect impacts of mitigation and adaptation measures taken by society could also significantly affect biodiversity. Thus, the multiple benefits of ecosystem-based approaches to climate change adaptation and mitigation should be demonstrated to other sectors and stakeholder groups in order to foster the integration of biodiversity concerns in adaptation and mitigation strategies ("mainstreaming").

Conservation science is increasingly dealing with the topic of climate change and its complex interactions on biodiversity and general guidelines and recommendations on adaptation have been elaborated. However, the implementation of these findings at this point of time is rather slow (due to different reasons, for example: uncertainty about future climate change impacts, lack of data in particular on ecosystem services or lack of finance, see: Bonn et al., in press).

Thus, the German Federal Agency for Nature Conservation (BfN) and the European Network of Heads of Nature Conservation Agencies (ENCA) in co-operation with the Freie Universität Berlin have invited to this conference to highlight and debate the importance of adapting to climate change in conservation. The envisaged overall conference output is to develop a roadmap to put adaptation principles into action.

2 BfN's activities on biodiversity and climate change.

This conference, which is already our fifth major event on the topic of Climate change and Nature Conservation and the second international one, is only a part of the range of BfN's activities in this field, which will be presented below.

The German Federal Agency for Nature Conservation (BfN) is the German government's scientific authority with responsibility for national and international nature conservation. BfN is one of the government's departmental research agencies and provides the German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety with professional and scientific assistance in all nature conservation and landscape management issues and in international cooperation activities. BfN furthers its objectives by carrying out related scientific research and is also in charge of a number of funding programmes.

Thus, the BfN plays a central role at the “science-policy interface” since it is linking science, policy and practice at the national level, the European level (e.g. as partner within the ENCA-network of European Nature Conservation Agencies), and the international level (e.g. in the negotiation processes of the Convention on biological Diversity, CBD; the Framework Convention on Climate Change, UNFCCC; and the Intergovernmental Platform on Biodiversity and Ecosystem Services, IPBES).

Climate change is a cross-cutting issue relevant to the tasks of most of BfN’s working units: This includes research projects, funded large-scale nature conservation projects as well as outreach activities and conferences.

2.1 Research projects

Here, a few examples of our research projects of which some were presented during this conference are briefly highlighted:

Several projects are dealing with the direct and indirect impacts of climate change on biodiversity and protected sites (e.g. Rabitsch et al. 2010, Ellwanger et al. 2012) and how to communicate them with the help of indicators. Other projects elaborate adaptation strategies e.g. through ecological networks or altered management strategies (e.g. Reich et al. 2012, Milad et al. 2012).

Some research also has been conducted on ecosystem-based approaches to adaptation and mitigation (e.g. Doswald & Osti 2012). Further research projects deal with ecosystem functions in relation to climate change (Scholz et al. 2012), in particular also in economic terms (Drösler et al. 2012). Thus, the BfN funds an analysis of climate policy and natural capital within a larger project on economic valuation of ecosystem-services in Germany (TEEB-DE, in press). Since a transformation of the energy system (“Energiewende”) is taking place in Germany right now, most of our projects which started recently, focus on possible conflicts and synergies in this field. But since these are still ongoing activities, results can only be presented in the future.

2.2 Large-scale Nature Conservation Projects

In addition, the BfN funds a series of large-scale nature conservation projects with a focus not only on climate change, but which might create win-win-situations and synergies between prevention of flood events, adaptation to climate change and nature conservation, which for instance is true for floodplain conservation and dike relocation (see section 3 below).

2.3 Public outreach activities and conferences

Furthermore, the BfN cooperated with partner agencies from Austria and Switzerland in publishing a book on Climate change and biodiversity for the interested public (Essl & Rabitsch 2013). And for many years, several workshops and conferences on climate change and biodiversity have been organized at our branch office, the International Academy for Nature Conservation located at the Isle of Vilm in the Baltic Sea as well as in our main office, here in Bonn or like this conference in related premises[1].

[1] For an overview see our web-page at: http://www.bfn.de/0307_veroeffentlichungen.html

3 Ecosystem based approaches to adaptation and mitigation

One main hypothesis that forms the basis of this conference is that nature conservation projects do not only stand for themselves but might create synergies with adaptation and mitigation. This issue is briefly illustrated with two examples from our research projects:

The large scale nature conservation project “Lenzener Elbtalaue” is located in the German Federal State of Brandenburg. In a core project area of 1,031 ha an area of 420 ha for water retention could be created through dike-relocation, thus leading to a decrease in flood wave peaks between 20 and almost 40 cm downstream[2].

The currently biggest dike-relocation in Germany has been carried out since 2001 (foreseen end is in 2018) in the project “Mittlere Elbe”, also a large scale nature conservation project which is located in Saxony-Anhalt. The project area encompasses 5,700 ha and it is foreseen to create about 600 ha retention space, leading to up to 28 cm reduction of flood wave peaks, which is an important contribution to flood control[3].

Both projects serve important and multiple nature conservation goals and services not only for biodiversity but for the re-establishment of natural flood-dynamics, back-waters and alluvial forests in order to restore typical riparian ecosystems and species. In addition, they create other important co-benefits like nutrient retention (Scholz et al. 2012). And furthermore: mineral soils which make up a large part of active floodplains in Germany have high carbon stocks compared to the surrounding landscape. Together with the carbon stocks found in the aboveground biomass of riparian forests, the values obtained for Germany are much greater than those of any other forest ecosystems in Central Europe. Also, the considerable carbon-sequestration potential of new creations of riparian forests (acting as carbon-sinks) should be taken into account. And last but not least, natural flood plains provide recreational services since usually they attract a lot of people for leisure.

Peatlands derive multiple benefits not only for biodiversity but for climate protection, water balance, accumulating and filtering nutrients, local climate and recreation. The goal of the BMU/BfN-Project “Contribution of selected protected areas for mitigation and their economic evaluation” (Drösler et al. 2012) was to quantify the ecological service “climate protection” in large scale conservation projects and to assess the costs for the CO_2-abatement. As the measures in these areas were originally not oriented to enhance the climate protection potential, but were specifically planned to optimize mainly the habitat function, this study allowed to analyse the independent co-benefits of nature protection measures for climate protection.

The economic calculations based on all available cost sources derived area-specific CO_2-abatement costs of 27 to 107 Euro per t CO_2**.** But because of different coverage of finance sectors the comparison between the test areas is limited. However, the detected cost range can compete with, or is even cheaper than other land-use oriented mitigation options, like bio-fuel and bio-gas. Thus, it could be shown that conservation measures in large scale conservation projects lead to a positive effect of climate mitigation and that they are economically viable (Drösler et al. 2012).

These examples show how win-win-situations between nature conservation, adaptation to climate change and mitigation can be gained and should be actively promoted.

---

[2] For more information on the project see: http://www.bfn.de/0203_lenzen+M52087573ab0.html

[3] For more information on the project see: http://www.bfn.de/0203_mittlere_elbe+M52087573ab0.html

References

Bonn, A., Macgregor, N., Stadler, J., Korn, H., Stiffel, S., Wolf, K. & N. van Dijk (in press): Helping ecosystems in Europe to adapt to climate change. BfN-Skripten. German Federal Agency for Nature Conservation (BfN), Bonn.

Doswald, N. & Osti, M. (2012): Ecosystem-based approaches to adaptation and mitigation – good practice examples and lessons learned in Europe. - Bundesamt für Naturschutz (BfN); BfN-Skripten Bd. 306, 43 S.

Drösler, M. et al. (2012): Beitrag ausgewählter Schutzgebiete zum Klimaschutz und dessen monetäre Bewertung.- Bundesamt für Naturschutz (Hrsg.), BfN-Skripten Bd. 328, 152 S.

Ellwanger, G., Ssymank, A. & Paulsch, C. (2012): Natura 2000 and Climate Change – a Challenge.- Federal Agency for Nature Conservation (BfN, ed.), Naturschutz und Biologische Vielfalt, Bd. 118, 211 S.

Essl, F. & Rabitsch, W. (Hrsg., 2013): Biodiversität und Klimawandel. Auswirkungen und Handlungsoptionen für den Naturschutz in Mitteleuropa.- Springer, Berlin/Heidelberg, 458 S.

Reich, M.; Rüter, S.; Prasse, R.; Matthies, S.; Wix, N. & Ullrich, K. (2012): Biotopverbund als Anpassungsstrategie für den Klimawandel.- Bundesamt für Naturschutz (Hrsg.), Naturschutz und Biologische Vielfalt, Bd. 122, Bonn-Bad Godesberg, 232 S.

Scholz, M.; Mehl., D.; Schulz-Zunkel, C., Kasperidus, H.D.; Born, W. & Henle, K. (2012): Ökosystemfunktionen von Flussauen. Analyse und Bewertung von Hochwasserretention, Nährstoffrückhalt, Kohlenstoffvorrat, Treibhausgasemissionen und Habitatfunktion.- Bundesamt für Naturschutz (Hrsg.), Naturschutz und Biologische Vielfalt, Bd. 124, Bonn-Bad Godesberg, 257 S.

TEEB DE (in press): Naturkapital und Klimapolitik – Synergien und Konflikte Kurzbericht für Entscheidungsträger. Helmholtz-Zentrum für Umweltforschung – UFZ, Leipzig; Technische Universität Berlin, Berlin.

4.3 Keynote presentations

Climate Change in Europe

Hartmut Grassl
Max Planck Institute for Meteorology, Hamburg, Germany

Europe's climate zones range from small ice caps to subtropical semi-deserts. Therefore ongoing and projected future anthropogenic climate change will show many different facets in different parts of Europe, e.g. from strong increases in precipitation throughout the year to strong reduction in (summer) precipitation. Due to a leading role both in climate research and partly in climate policy-making the possibilities for an intelligent adaptation to climate change and thus less vulnerability of European societies are better than in most other regions. Due to its historical and in parts still ongoing major contribution to the enhanced greenhouse effect of the global atmosphere, Europe is - in addition - not only forced to strong mitigation efforts but also to strong help in climate change adaptation for the developing countries, which are not responsible to a large degree for ongoing climate change. This talk shows what we already know about climate change with a focus on Europe, where the main uncertainties lie concerning the extent of expected global anthropogenic climate change, what is already unavoidable and thus needs adaptation measures, and how long the anthropocene will last depending on climate politics in the coming few decades.

Biodiversity Conservation in a Changing Climate

CHRIS D THOMAS
University of York, UK

Climate change is generating large changes in the geographic distributions of species across the planet. For example, in Britain, the comma butterfly has spread northwards by around 300 km in the last 40 years. More generally, a wide variety of vertebrate, insect and other invertebrate groups have spread northwards, at an average of around 5 m per day (or around 50 km in 25 years; from British data), and plant distributions are known to be shifting to higher elevations in other areas of Europe. Species are also declining at their southern and low-elevation range boundaries. This is a global phenomenon, with our recent meta-analysis of published data (much of it from Europe) revealing a median rate of range shifting of 17 km per decade towards the poles. These averages and medians hide a diversity of individual responses, with some species apparently responding rather little, and others like the comma butterfly changing their abundances and distributions with great rapidity. Thus, the distributions of species and biological communities have already changed as a result of climate change, even in protected areas.

Future projected warming (on current emissions and warming trajectories) will result in global average temperatures not seen for over 3 million years, and atmospheric CO_2 concentrations not experienced for over 20 million years. Thus, the biological systems of the Earth are set for major re-organisation. Many species are likely to show little or no overlap between their current distributions and where the climate is expected to be suitable for them in future, and a number of studies suggest that of the order of 10% to 30% of species are likely to be threatened with global extinction.

These fundamental changes to the physical environment and biological systems provide serious challenges to the philosophy of conservation. The conservation triplet of ensuring that habitat survives at all (e.g., through reserves), maintaining high quality habitats (e.g., through management), and in some circumstances recreating habitats (e.g., restoration and re-introduction projects) is underpinned by a philosophy of trying to keep things as they are, or even trying to restore the past. This is no longer possible. The forthcoming century of ongoing climate change means that the composition of biological communities cannot be stopped, even on reserves, and that the continuation of traditional land management, a key feature of European conservation, will no longer "deliver" the same biological communities that used to benefit from this management. This does not mean that land protection and management are outmoded, but that the outcome will change. It already has.

Climate change and other pervasive drivers of global change (including nutrient deposition and megafauna removal) mean that nowhere on Earth can be considered entirely "natural" any longer, in the sense of being unaffected by human intervention. This is particularly the case in Europe. Equally, distributions of species are dynamic not static and the composition of biological communities is changing. In addition to changes in the native (to a country or to Europe) species and communities, species from other parts of the world are increasingly joining the species pool, and contributing to the new communities. They cannot all be removed, and the majority have relatively little impact on the pre-existing biota. The philosophy of a default negative attitude to non-native species is untenable in the Anthropocene. Increasingly, we will have to accept that species are native to Europe or to the entire planet, rather than express prejudice about the origin of a species. There are circumstances where this default is wise (e.g., endemic-rich oceanic islands), but species are better judged (from a human perspective) by their impacts, not by their origins.

All of the above requires a philosophical change in conservation thinking to one of managing change in a way that we, as humans, regard as acceptable, rather than holding onto the idea that we can keep things as they are. The latter will result in an increasing drain of resources, fighting lost causes. Embracing managed change as a new philosophy can be extremely positive. For example, if one's conservation target is to minimise the global rate of extinction of species, assisting endangered species to reach new climatically-suitable areas outside their current distributions can be seen as positive action.

Conservation strategies

Broad strategy	Recent	Future
• ***in situ*** (reserves, protection, etc. in existing range)	primary	**increased** (more, bigger, better, heterogeneous, engineered)
• ***ex situ*** (zoos, botanic gardens, gene/seed banks)	secondary	**increased** (gene banks, for *trans situ*)
• ***trans situ*** (moved to *new* locations)	trivial	**increased** (joined up, moved)

In general, the current emphasis on *in situ* conservation should continue to have the strongest emphasis because species need good habitats in the places where they currently live, in the places where they will be able to survive under future climates, and they also need suitable habitats where they can establish stepping-stone populations in-between. Indeed, we already have good evidence from Britain that a majority of species of insects and birds are disproportionately colonising protected areas (SSSIs, Natura 2000 sites) as they shift their distributions polewards. *Ex situ* conservation will also continue to be important and will increase to some extent, but the capacity of *ex situ* conservation to contribute to re-establishment programmes may be somewhat limited (by costs). On the other hand, seed banks and frozen zoos can provide a good record of what we have on Earth at present – but such stores do not provide ongoing ecosystem goods and services (other than genetic resources), and it is hard to imagine that significant fractions of such species will be brought out of the cold and reintroduced to the wild centuries after their incarceration. The third broad strategy is *trans situ* conservation, as I call it, in which steps are taken to move (or enable species to move on their own) to new locations. This is set to increase, but conservation bodies and society in general do not yet have sufficient structures and frameworks within which such activities can take place. *Trans situ* conservation will require the greatest re-consideration of existing strategies. The most endangered species on the planet will lose out to widespread generalists under climatic and other changes. *Trans situ* conservation has at least some potential to save a number of globally-endangered species by establishing them in new regions that they could not reach unaided.

Managing the Natura 2000 network in the face of climate change – challenges and opportunities

MICHAEL O'BRIAIN
Deputy Head of Nature Unit, DG Environment, European Commission

The new 7th EU Environmental Action Programme recognises the need for an integrated approach to address EU goals of limiting and adapting to climate change as well as to halting and reversing the loss of biodiversity and ecosystem services. The 2013 EU Adaptation Strategy[1] promotes action by Member States to adopt comprehensive adaptation strategies. The 2013 Commission Communication on Green Infrastructure[2] promotes a strategically planned and delivered network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. This also provides new opportunities for ecological connectivity as foreseen under Article 10 of the Habitats Directive.

Natura 2000 represents Europe's areas of high biodiversity value and is a core element of Green Infrastructure. It is the largest coordinated network of protected areas in the world, embracing 26,400 sites and covering 986,000 km² (18% EU land, ~4% EU seas). It is almost complete on land with some additional work for the marine. Now that the network is largely established the focus is on the effective protection, management and restoration of sites in Natura 2000.

This includes minimising negative effects of climate change mitigation measures on Natura 2000. There are risks from poorly planned energy related developments such as for wind, hydro, tidal, biofuels and grid connection infrastructures. Any such developments in Natura 2000 areas must respect the legal safeguards and procedures set out in Article 6 of the Habitats Directive. EU guidelines on wind energy underline the value of strategic spatial planning over a broad geographical area.

The Commission services, with support from ALTERRA and EUROSITE, have also recently issued EU guidance on Natura 2000 and climate change[3]. Primarily aimed at site managers and policy makers this assesses the risk to species and habitats of EU interest, underlines benefits of working with nature in mitigating the impacts of climate change, reducing vulnerability and increasing resilience and provides practical advice on how to address climate change in the management of Natura 2000 at site and network level. The guide, which includes good practice case studies, is structured as follows:

- Chapter 1 recognises that the EU already faces unavoidable impacts of climate change that will affect the full EU territory, with regional differences
- Chapter 2 looks at ways that managing Natura 2000 sites can increase their mitigation or adaptation role, whilst at the same time delivering conservation objectives
- Chapter 3 describes risks to species and habitats. A supplement to the guide provides an indication of vulnerability and adaptation potential of different Natura 2000 species and habitats

---

[1] COM/2013/0216 final

[2] COM(2013) 249 final

[3] http://ec.europa.eu/environment/nature/climatechange/pdf/Guidance%20document.pdf

- Chapter 4 introduces the concept of adaptive management, a structured, iterative process of optimal management decision-making in the face of uncertainty, based on systems monitoring
- Chapter 5 examines 6 categories of adaptation measures for Natura 2000 that can be applied on-site, in the surroundings or at network level
- Chapter 6 provides a decision making framework as a tool to facilitate decision making
- Chapter 7 provides advice & recommendations for site managers & policy makers

There are co-financing opportunities under the main EU sectoral funds (e.g. Common Agricultural Policy, Structural and Cohesion Funds, European Maritime and Fisheries Fund) for both climate change and biodiversity. Prioritised Action Frameworks (PAFs) are being developed for Natura 2000 as a tool to help strategic planning as well as identification of priorities and of financing sources under the different EU funds. The future LIFE Programme for Environment & Climate Action foresees 75% to Environment (half to nature and biodiversity) and 25% for Climate Action. The Biodiversity strand will in particular support Natura 2000 sites, especially via integrated projects consistent with PAFs. The Climate strand will include support for 'Climate Change Adaptation': through measures that increase resilience to climate change.

As Natura 2000 sites provide critical space for nature in the face of climate change a key objective has to be to reduce non-climate pressures & increase resilience to climate change. Monitoring systems will need to distinguish between natural and climate effects and management failures.

Contact

Micheal O’Briain
DG Environment, European Commission
5 Avenue de Beaulieu
1160, Brussels
Belgium
micheal.o’briain@ec.europa.eu

Novel freshwater ecosystems in a changing climate: A challenge for research and conservation

KLEMENT TOCKNER
Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Germany

All ecosystems can be arranged along a gradient of domestication, from pristine, wilderness landscapes, to fully domesticated systems including constructed ecosystems such as reservoirs and urban spaces. Domestication means that ecosystems have been optimized for few ecosystem services that provide major economic benefit to humans, yet concurrently causing unforeseen changes in other ecosystem attributes. In its simplest form, domestication of ecosystems means that nature is exploited and controlled (Kareiva *et al*. 2007).

In this presentation, based on a recently published essay (Tockner et al. 2011), I will focus on large river-floodplain systems because these ecosystems represent a broad spectrum of domestication, and as many of them have been domesticated for hundreds of years. For example, in Germany, 22% of the surface area of all major rivers is accounted for by the 7,700 km long inland waterway network. In the east of Germany, in the state of Brandenburg, 80% of running waters are artificial (drainage ditches; Hüttel et al. 2011).

Large rivers are increasingly dominated by novel communities that do not share a common evolutionary development, and therefore lack interspecific adaptations as well as historical analogies or references. For example, the benthic communities along the rivers Rhine and Danube are composed of up to 80% of non-native species. In Mediterranean rivers up to 60% of all fish species are introduced species, thereby creating novel communities and increasing the homogenization of the fauna. Homogenization is caused by fish stocking, dispersal across biogeographic boundaries through an extensive navigation network, uniform habitat conditions along heavily modified large rivers, as well as by vessel-induced physical forces such as wave stress. The rapid turnover of communities along large rivers makes it difficult to predict which communities we may expect in 20 or 50 years.

How do novel communities form, and what are the ecological and evolutionary consequences? What are potential consequences for biodiversity and ecosystem functioning, and which adaptive strategies are required to manage domesticated ecosystems and novel communities? These are some of the challenging, and central, research questions for providing the background for the sustainable management of large rivers.

Domestication of ecosystems, combined with the rapid turnover of biotic communities, calls for a fundamental rethinking of the future management of freshwater ecosystems. Persistent emphasis on an idealistic vision of ecosystems – which is still common in associations dedicated to nature and species protection – may not be feasible for ecosystems that continuously change and are dominated by novel communities. Conservation efforts will need to be complemented by, or perhaps even replaced by, increasing levels of management intervention, in order to create and maintain the desired ecological values of ecosystems. It is a key challenge in science and management to determine the extent to which the negative trade-offs of domestication can be avoided by changing the way ecosystems are managed. It is becoming ever more evident that pure conservation and “human-outside-nature” approaches will be insufficient in managing most of our ecosystems (Dufour, Piegay 2009).

Among the great challenges for management is the development of synergies among the currently competing objectives in agriculture, navigation, industry, and ecology. A fundamental question that needs to be answered is how much water, of what quality, does an aquatic ecosystem need in order to ensure its fundamental ecological functions as well as a rich biodiversity? As long as we are not able to provide clear and justified answers to this question, the allocation of available water will be carried out at the expense of the ecosystem.

In domesticated ecosystems, nature is exploited and controlled for short-term human benefits (Kareiva *et al*. 2007, Tockner et al. 2011). In so doing, there is a risk that landscapes will be engineered and designed to provide ecosystem services in the most cost-effective way. It is therefore indispensible for the future development of management strategies to improve the balance between the short-term benefits of domestication and its long-term consequences. We admit that this is an approach that is not particularly inherent in human actions.

References

Dufour S., Piégay H. (2009): The myth of the lost paradise to target river restoration: forget natural reference, focus on human benefits. River Res. Appl. 25, 568-581.

Hüttl, R.F., Emmermann, R., Germer, S., Naumann, M., Bens. O. [Eds] (2011): *Globaler Wandel und regionale Entwicklung. Anpassungsstrategien in der Region Berlin-Brandenburg*. Springer. Heidelberg.

Kareiva, P., Watts, S., McDonald, R., Boucher, T. (2007): Domesticated nature: Shaping landscapes and ecosystems for human welfare. *Science* 316, 1866–1869.

Tockner, K., Gessner, J., Pusch M.T. and Wolter C. (2011): *Domesticated ecosystems and novel biotic communities: Challenges for water management*. Ecohydrology and Hydrobiology 11:167-174.

Contact

Klement Tockner
Leibniz-Institute of Freshwater Ecology and Inland Fisheries
Müggelseedamm 310
Berlin, 12587Germany
tockner@igb-berlin.de
www.igb-berlin.de

Spatial planning of Green Infrastructure in a changing climate

Rob H.G. Jongmann, E. Steingrover, I.M. Boumwa
Alterra, Wageningen UR, The Netherlands

The consequences of climate change are that ecosystems will change. This will happen at both local and biogeographic level. At the local level ecosystem change will mean changing agricultural production, different crops, management intensities and cycles. At the regional level ecosystems will change place and biogeographic regions might change in position and size (Metzger et al. 2008). Natural species meet sub-optimal conditions and tend to move in a direction of better conditions expressed in better habitat conditions, where they can find better food conditions and less competition. Some species will meet unfavourable conditions for survival and may get extinct in Europe or regionally.

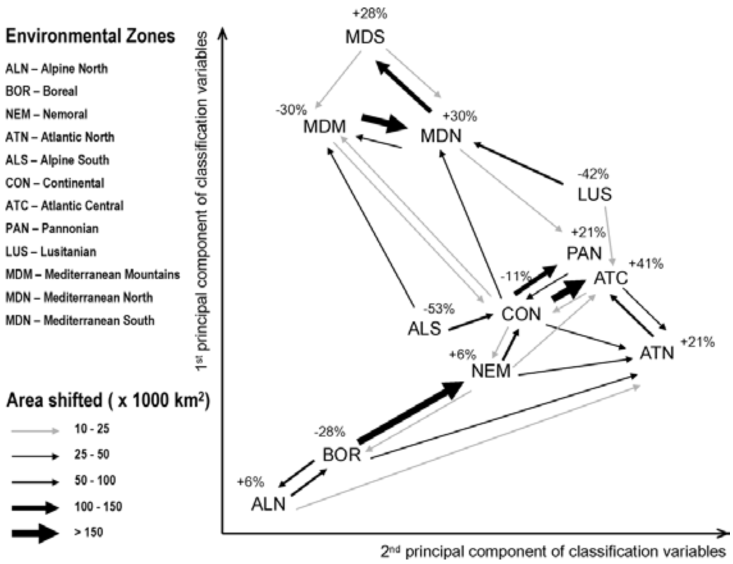


Figure 1: Shifting bioclimate in Europe in a scenario of climate change. The change is not unidirectional, but multidirectional. The general trend is towards warmer climates, but opposite shifts are possible as well.

Climate change will certainly impact Natura 2000 sites. What that impact is depends on the geographical position, characteristics of the site, the species present and the surrounding environment (Bouwma et al. 2013). However, although many measures can be taken in and around sites, connectivity is important as well to provide a network that allows species to move from one place to another. Here Green Infrastructure or ecological network systems become important as larger scale (network level) adaptation measures should be considered and this requires planning. Measures at the network level are important to enable species to disperse from present to sites, which might become suitable in due time. This will require green infrastructure over large distances, as the suitable climate zones for many species are predicted to move several hundreds of kilometres. This asks for national and international cooperation to find the best routes and opportunities for implementation of cross border measures.

Green Infrastructure can improve connectivity as it can include stepping-stones and corridors. In intensively used agricultural areas, the wider landscape is often not suitable for the dispersal or migration of species. Small, natural landscape elements within the agricultural landscape - such as tree lines, hedgerows, road/waterway verges, ponds, small woods etc. - provide more suitable areas for dispersal and migration of some species groups.

However, often these natural landscape ‘routes’ are scattered and of poor quality from a biodiversity perspective. By taking into account in the planning process the species’ requirements concerning the robustness and quality of corridors and stepping stones, the role of Green Infrastructure can be enhanced.

Planning is required for the implementation of measures to reduce the barrier effects of roads, railways and technical objects in rivers and streams to facilitate species spatial responses to climate change. Human-made infrastructure inhibits the dispersal and migration of species. Technical solutions exist to make new infrastructure more passable for many species or to change existing infrastructure.

The main aspect of spatial planning is the need for cooperation between parties involved. This means that road planners, farmers, citizens of nearby towns and villages should interact with each other and learn about each other’s needs. They have to be involved in these processes, learn what is coming towards them due to land us change, climate change and ecological and societal adaptations and integrate that in their daily living and working pattern. This is the most neglected part of spatial planning but essential to build a common future.

References

Bouwma, I.M., C. Vos, M. Biemans, N. McIntosh, R. van Apeldoorn & P. Verdonschot (2012): Draft Guidelines on Climate Change and Natura 2000: Dealing with the impact of climate change on the management of the Natura 2000 Network. DG Environment.

Metzger, M.J., R.G.H. Bunce, R. Leemans and. D. Viner (2008): Projected environmental shifts under climate change: European trends and regional impacts. Environmental Conservation 35 (1): 64–75.

Contact:

Rob H.G. Jongman
Alterra, Wageningen UR
PO Box 47
NL-6708NJ Wageningen, The Netherlands
Rob.jongman@wur.nl
http:www.wageningenur.nl/alterra

4.4 Presentations

Enhancing Resilience in Natural Environments

Mike Morecroft
Natural England, UK

There are two broad approaches to climate change adaptation in the natural environment: building resilience and accommodating change. Building resilience is about enabling the persistence of species, habitats and ecosystems in their present locations. Accommodating change means accepting new circumstances and facilitating outcomes that contribute to higher level conservation objectives, for example enabling changes species distribution or the natural development of the coastline in response to rising sea levels.

Resilience is a broad concept and is used in different ways. It can mean the capacity of systems to go on functioning through ongoing pressures, or it can mean the capacity to recover from a disturbance. Both are relevant to climate change adaptation, but it is important to be clear about meaning in specific situations in which the word is used.

A number of approaches to adaptation have been proposed to increase resilience of ecosystems, including the following (Morecroft et al. 2012):

- Reduce other pressures on biodiversity
- Increase the number of protected sites
- Increase the size of individual protected sites
- Provide buffer areas around protected sites
- Improve the functional connectivity between sites
- Protect/create cool microclimates and potential refugia for species
- Maintain or increase the habitat heterogeneity at site and landscape scales
- Maintain species diversity within communities
- Protect natural processes
- Promote the potential for natural genetic exchange between populations
- Control invasive species

Resilience is not entirely distinct from accommodating change: change at one level of organization may promote resilience at a higher level: for example encouraging the establishment of tree species or genotypes better adapted to a warmer climate may help to maintain a forest ecosystem on a site.

There is a fundamental question about the balance between building resilience and accommodating change. In what circumstances should we give up on enabling persistence and facilitate change? In the UK we are starting to see the impacts of climate change and have recently published a major report on this (Morecroft and Speakman 2013). It is important that conservation recognises where change is taking place and does not use resilience as an excuse for inaction. At the same time we are also seeing evidence that species can persist in spite of climate change and developing a better understanding of what factors are most effective in promoting this will allow us to make informed decisions in different situations.

Ultimately the possibility of building resilience will be constrained by the magnitude of climate change. If projections of more extreme changes in climate prove to be accurate, a more radical, transformational approach would become necessary in the face of major biodiversity losses. We are not in that situation at present however. We must also take account of the potential for unexpected changes and developing a good understanding of the nature of resilience and how we can enhance it should be basis of adaptation.

References

Morecroft, M. and Speakman, L. (eds.) (2013): Terrestrial Biodiversity Climate Change Impacts Summary Report. Living With Environmental Change. http://www.lwec.org.uk/resources/report-cards/biodiversity

Morecroft, M.D.; Crick, H.Q.P.; Duffield, S.J. & Macgregor, N.A. (2012): Resilience to climate change: translating principles into practice. Journal of Applied Ecology. 49: 547-551

Contact

Dr. Mike Morecroft
Natural England
Cromwell House, Andover Road,
Winchester SO23 7BT, UK
mike.morecroft@naturalengland.org.uk
http://www.naturalengland.org.uk/ourwork/climateandenergy/climatechange/default.aspx

(personal web page http://www.geog.ox.ac.uk/staff/mmorecroft.html)

Conservation strategies for species – meeting the challenges of alien species and endangered species

Gian-Reto Walther
Species, Ecosystems, Landscapes Division, Federal Office for the Environment (FOEN), Switzerland

Starting from the national activities elaborating a strategy on the adaptation to climate change, the many ways of how biodiversity is affected by climate change is highlighted. These include all hierarchical levels from the genetic, to the species, habitats and ecosystem level (Fig. 1). However, formulating appropriate measures that adequately tackle these issues pose challenges, with some of them being addressed in the following:

The knowledge on functions and patterns of genetic diversity is increasing, but at the same time also the challenges. As an example, a recent study on the genetic diversity in alpine vascular plants of the Alps has investigated whether the genetic and species levels of biodiversity co-vary (Taberlet et al. 2012). In this case it was shown that species richness and genetic diversity are not correlated and thus, species richness cannot act as a surrogate for genetic diversity. As a consequence, the protection of both levels of biodiversity within the same protected area is not always given, and therefore protected areas must not be restricted to areas of high species diversity but complemented with others dedicated to genetic diversity.

New challenges arise not only on the genetic level. With species shifting their ranges due to climate change, Araujo et al. (2011) wondered how effectively protected areas conserve biodiversity under climate change and assessed the effectiveness of such areas for a large proportion of European plant and terrestrial vertebrate species. A country-by-country analysis quantifyed whether species are expected to win or lose climate suitability under climate change and revealed considerable changes among the various countries in Europe. It is likely, that future suitable habitats for species are located in (conservation) areas of countries, outside the range of the species under present conditions.

With regard to definitions, the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats (2009) expressed the worry that native species moving to neighbouring areas may be considered as alien due to the fact that climate change is the result of human action and that such species may be unnecessarily controlled. It recommended contracting parties to interpret the term 'alien species' as not including native species naturally extending their range in response to climate change. However, species extend their range not only naturally but also facilitated by humans. Van der Veken et al. (2008) have shown that commercial ranges of native European plant species exceeded their natural northern range limits with a mean difference of ~ 1,000 km. In this context, also the activities using assisted migration as a management tool for species threatened by climate change as e.g. known from Australia (NCCARF undated) are worth mentioning.

Finally, and as an example of challenges on the ecosystem level, Williams (1997) outlined that rapid reorganisation of ecological communities will occur with indigenous species shifting ranges or becoming extinct, and pre-adapted non-indigenous species invading vacant niches. In this regard, non-indigenous species may have considerable ecological value in the future, perhaps playing key structural and functional roles in post-climate change communities. Hence, there is an issue with continued climate change not only on risks of alien species in a warmer world but also the opportunities of (non-invasive) alien species (Walther et al. 2009).

The few examples highlighted some of the challenges of endangered species and alien species for conservation strategies under climate change. Depending on the magnitude and rate of climate change, the question is not whether but when we are forced to consider these challenges in the conservation strategies.

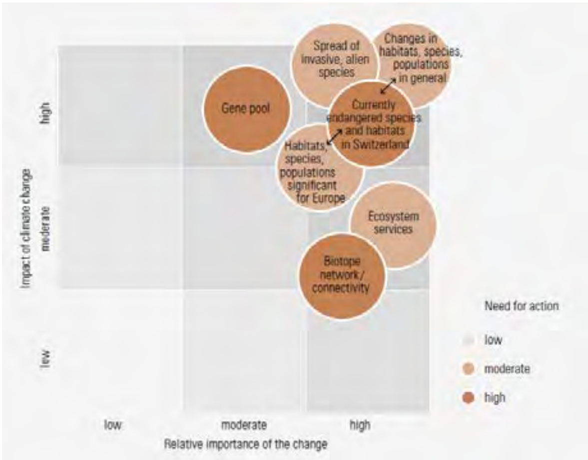


Figure 1: Assessment of relevant areas of climate change impacts on biodiversity as identified in the Federal Council's strategy '*Adaptation to climate change in Switzerland*' (only areas with a score higher than 'low' in all three criteria (impact of climate change, relative importance of the change, need for action) are shown).
(http://www.bafu.admin.ch/publikationen/publikation/01673/index.html?lang=en)

References

Araujo M.B., Alagador D., Cabeza M., Nogues-Bravo D. & Thuiller W. (2011): Climate change threatens European conservation areas. *Ecology Letters* 14: 484–492.

NCCARF (National Climate Change Adaptation Research Facility) (undated): Information Sheet 2 – Assisted migration as a management tool for species threatened by climate change.
(http://nccarf.jcu.edu.au/terrestrialbiodiversity/download/information_sheet_2_assisted_migration.pdf)

Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats (2009): Recommendation No. 142 (2009) of the Standing Committee, adopted on 26 November 2009, interpreting the CBD definition of invasive alien species to take into account climate change. (https://wcd.coe.int/ViewDoc.jsp?id=1560527&Site=DG4-Nature&BackColorInternet=DBDCF2&BackColorIntranet=FDC864&BackColorLogged=FDC864)

Taberlet P., Zimmermann N.E., Englisch T., Tribsch A. Holderegger R., et al. (2012): Genetic diversity in widespread species is not congruent with species richness in alpine plant communities. *Ecology Letters* 15: 1439–1448.

Van der Veken S., Hermy M., Vellend M., Knapen A. & Verheyen K. (2008): Garden plants get a head start on climate change. Frontiers in Ecology and the Environment 6: 212–216.

Walther G.-R., Roques A., Hulme P.E., Sykes M.T., Pysek P. et al. (2009): Alien species in a warmer world: risks and opportunities. Trends in Ecology and Evolution 24: 686–693.

Williams C.E. (1997): Potential valuable ecological functions of nonindigenous plants. In: Luken J.O. & Thieret J.W. (eds.) Assessment and Management of Plant Invasions. Springer-Verlag, New York, pp 26–34.

Contact

Gian-Reto Walther
Federal Office for the Environment FOEN
Species, Ecosystems, Landscapes Division
CH-3003 Bern, Switzerland
gian-reto.walther@bafu.admin.ch
http://www.bafu.admin.ch/index.html?lang=en

The ecosystem-based approach: Concepts and implementation

Timo Kaphengst, Sandra Naumann
Ecologic Institute, Germany

In response to the growing pressures of climate change, the maintenance and restoration of natural habitats has emerged as an effective strategy to increase the resilience of ecosystems and support sustainable livelihoods.

The concept of an 'ecosystem-based approach' builds on the Convention on Biological Diversity's (CBD) definition, stating that: "the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" and which aspires to maintain the natural structure and functioning of ecosystems. Ecosystem-based approaches address the crucial links between climate change, biodiversity, ecosystem services and sustainable resource management and thus have the potential to simultaneously contribute to the avoidance and reduction of greenhouse gas emissions and the enhancement of sinks - inter alia - through increased carbon sequestration. These approaches also maintain existing carbon stocks, regulate water flow and storage, maintain and increase resilience, reduce vulnerability of ecosystems and people, help to adapt to climate change impacts, improve biodiversity conservation and livelihood opportunities and provide health and recreational benefits.

However, the integration and implementation of such ecosystem-based approaches is still lacking while awareness of the concept and its potential remains substantially low. Through the assessment of 161 applicable projects, the conduction of five in-depth case studies, targeted interviews with European Commission officials and a literature review, the study presented here assessed the success factors leading to and obstacles hindering the implementation of ecosystem-based approaches in climate change adaptation and mitigation strategies at various spatial scales. The study identified main barriers ranging from

- technical challenges (design and implementation of effective strategies) to
- lack of capacity (institutional, financial or technical),
- organizational challenges (inappropriate management structures),
- political hurdles (lack of policy integration), and
- social/behavioural issues (habitual practices and socio-economic barriers).

In order to overcome these challenges, several factors were identified, including:

- project management experience amongst the staff,
- clear delineation of roles and transparent communication among project partners,
- stakeholder consultation and participation processes from the planning phase onwards,
- awareness raising about the current threats posed by climate change and biodiversity loss and the employed ecosystem-based approaches to address these threats.

Highlighting the multiple benefits of the proposed project, which are linked to ecosystem-based approaches is key within this context.

In the study recommendations were offered to overcome each of the identified challenges and recognise the potential of ecosystem-based approaches to contribute to a range of EU, national and regional climate change adaptation and mitigation policies as well as for supporting the EU 2020 Biodiversity Policy and the current EU Green Infrastructure Strategy.

Another more recent study conducted by the Ecologic Institute provides for comprehensive assessment of projects and initiatives applying ecosystem-based approaches in Germany, Austria and Switzerland. Some of the preliminary results will also be presented.

References

Naumann, S.; Anzaldua, G.; Berry, P.; Burch, S., Davis, M.; Frelih-Larsen, A.; Gerdes, H. and M. Sanders (2011): Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe. Final report to the European Commission, DG Environment, Contract no. 070307/2010/580412/SER/B2, Ecologic institute and Environmental Change Institute, Oxford University Centre for the Environment.

Naumann, S.; Davis, M.; Kaphengst, T.; Pieterse, M. and M. Rayment (2011): Design, implementation and cost elements of Green Infrastructure projects. Final report to the European Commission, DG Environment, Contract no. 070307/2010/577182/ETU/F.1, Ecologic institute and GHK Consulting.

Contact

Timo Kaphengst
Ecologic Institute
Pfalzburger Straße 43/44
Berlin, 10717
Germany
timo.kaphengst@ecologic.eu
http://www.ecologic.eu/

Climate Change Adapted Management in Protected Areas - Practical Experiences from Central and Eastern Europe

Sven Rannow
Leibniz Institute for Ecological Urban and Regional Development, Germany

During the last two decades much effort has been spend on identifying local impacts of climate change on biodiversity. Understanding the complex interaction of climate with abiotic, biotic and socio-economic systems is an essential basis for the development of effective and efficient adaptation strategies. However, this knowledge needs to be translated in concrete measures. A new generation of studies is putting stronger focus on relevance of research results for decision-making processes. Guidelines and frameworks try to transfer the available information in applicable knowledge. The plethora of this work is still on a theoretical level. Only few strategies have been tested in the field and even less response options have been evaluated regarding their applicability.

In the last three years the EU-funded project HABIT-CHANGE tested different adaptation approaches for protected areas. The science-management partnership brought together conservation managers from Central European National Parks, Biosphere Reserves and Nature Parks with conservation agencies and research institutions. The intensive discussion and exchange of experience between science and practice as well as between conservation sites helped to change the perspective used for the adaptation of conservation management. New challenges arise when research moves one step further from the question “What are the effects of climate change on biodiversity?” to the question “What can conservation management do?”.

Even though most work in impact research is focused on the identification of direct climate related effects on flora and fauna, the discussions revealed that the interaction of climate change with existing drivers of change in land use are at least as important. The autonomous adaptation of stakeholders to shifting climate conditions might bring new problems to conservation management and increase existing conflicts. A case study of Biebrza National Park in Poland illustrated how farmers are increasing drainage activities in response to changes in seasonality and frequency of flood events. Adaptation activities in other sectors like increased flood protection or changes in water management might have at least as severe impacts on biodiversity as the loss of habitat due to changing climate regimes.

Next to the discussion of potential impacts of climate change, the focus of the project moved to communication of climate effects and most of all to the identification of potential response options. Communication of climate related impacts has to focus on the transfer of knowledge between science, management and land users. Practice oriented guidance in non-scientific and national languages is a prerequisite to help conservation managers in their work. Most protected habitats can only be maintained cooperatively by conservation management and land users. Climate change adaptation for protected areas requires an integrated approach that balances conservation goals, economic growth, and social stability. Strong cooperation and effective coordination will increase the overall resilience of ecosystems in regard to functional and spatial aspects, but also improve its economic and social benefits, and thus raise the overall adaptive capacity of Central European regions.

In the years to come further evaluation of methods to identify and prioritise adaptation actions are needed. Up till now, the adaptation of conservation management is still dominated by learning-by-doing and ad hoc approaches. A systematic review of existing adaptation activities and an exchange of experience between protected areas will be essential to foster adaptation processes.

From the experience gained during the science-management cooperation of HABIT-CHANGE it can be concluded that:

- The perspective of conservation management differs from the perspective of current scientific impact research.
- Adaptation to climate change is a local process that needs to be run by local institutions.
- Involvement of stakeholders outside conservation management is essential to guarantee the successful implementation of climate adaptation actions on the local level.
- Conservation areas urgently need support in resources and capacity to assess impacts of climate change, develop adaptation strategies, persuade stakeholders of the necessity of adaptation, and to monitor changes in biodiversity (climatic and non-climatic driven).

Contact

Sven Rannow
Leibniz Institute for Ecological Urban and Regional Development
Weberplatz 1
01217 Dresden
Germany
s.rannow@ioer.de
www.habit-change.eu

Conserving European Forests under a Changing Climate? Analysing the Science-Policy-Practice Debate

Georg Winkel
Forest and Environmental Policy Group, Institute of Social Environmental Sciences and Geography, University of Freiburg, Germany

Climate change poses a challenge to forest conservation policies. First, forest ecosystems and forest management are connected to climate change in two related but distinct ways: on the one hand, they can contribute to mitigation via carbon storage and substitution effects, on the other hand, forest ecosystems need to be adapted to a changing climate. Second, the long duration of ecological processes (and related patterns of economic production) in forest ecosystems renders climate change adaptation a process that is characterized by numerous uncertainties. These uncertainties relate not only to the prognosis of climate change, but also to the reactions of forest ecosystems to a changing climate.

When it comes to policy making, scientific evidence, prognoses and uncertainties meet with the logic of politics. Forest conservation policies need to be newly discussed and reflected on in a context of diverging political beliefs, interests, and strategies. As a result, in the political discourse, climate change is not only a major challenge to be dealt with, but also a powerful argument to either strengthen or weaken certain concepts of forest conservation and management politically.

In this presentation, I will, first, analyse political discourses related to climate change and forest conservation. Drawing on analyses at different policy levels, it can be shown that climate change adaptation is discussed quite differently depending on the overall perspective the respective groups have on forests and forest management, leading to distinct policy implications. To a notable degree, climate change adaptation concepts mirror policy and management concepts that have been discussed already well before the issue of climate change came on the agenda. An illustrative example for this is the debate on Natura 2000 and climate change.

Second, I shortly assess the scientific debate related to the issues drawing on review papers that have been published on the issue of climate change adaptation and forests in nature conservation and forestry journals. In general, there is much agreement in the literature related to strategies such as increasing (bio)diversity of forest ecosystems, drawing on natural regeneration and close to nature forestry to facilitate natural (evolutionary) adaptation processes. Yet, there are also important differences between the forest and conservation sciences literature regarding adaptation that will be presented.

Third, I reflect on analyses of how forest practitioners across Europe deal with the issue of climate change. As a general rule, practitioners tend to be less polarised and interested in the issue of climate change adaptation at this stage, while existing responses in management differ significantly.

Concluding, it is emphasised that the process of adapting forest conservation policies and strategies to climate change is multifaceted and challenging as it involves not only uncertainty, but also how uncertainty is processed by distinct spheres of society (science, politics, practical management) that follow different logics. Yet, knowing about these differences is a good starting point for developing strategies that are suitable for all of these spheres. Finally, the necessity to discuss climate change adaptation of European forests in the context of other major ecologic, economic and political issues is underlined.

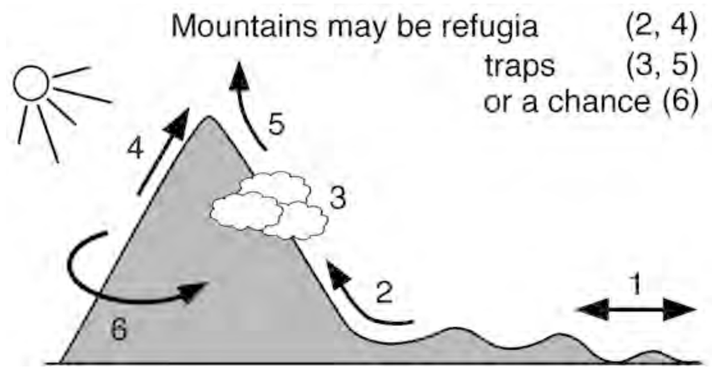
Contact

Dr Georg Winkel
Forest and Environmental Policy Group, Institute of Social Environmental Sciences and Geography, University of Freiburg
Tennenbacher Str. 4
79106 Freiburg
Germany
Georg.winkel@ifp.uni-freiburg.de
http://www.ifp.uni-freiburg.de/FoPo/ma-fopof/georg-winkel

Mountain ecosystems in a changing climate

Christian Körner
University of Basel, Switzerland

If defined by a minimum ruggedness, mountains cover 12.5% or 16.6 Mio km^2 of terrestrial land area outside Antarctica. Joining biota of the montane, alpine and nival belts, approximately one third of all higher plant species are found in mountains. The alpine life zone that comprises only 2.6% of the land area hosts about 4% of all angiosperm species, despite a large fraction of that area is barren or ice covered. This high biotic diversity results from the elevational compression of climatic belts over a small geographical area and topographic roughness (geodiversity), and thus, habitat diversity. As a consequence, mountains are prime locations for conservation. Often treated as harsh environments, these conditions are not harsh for organisms adapted to life at high elevations, and in fact, mountains always have been refugia, when climatic conditions changed. In this presentation I will discuss the likely consequences of environmental changes such as atmospheric CO_2 enrichment, a rise in temperature, nitrogen deposition and changes in land use, based on empirical evidence. I will focus on alpine biota and the alpine treeline, i.e. the transition from the upper montane forest to the treeless terrain above. I will conclude that warming effects above treeline will be buffered by topography effects, treeline will advance, elevated CO_2 in the alpine belt exterts no influence, nitrogen deposition is of great concern in exposed areas and land use may outway any other global change influence.



References

Inauen, N., Körner, C. and E. Hiltbrunner (2012): No growth stimulation by CO_2 enrichment in alpine glacier forefield plants. Global Change Biology, vol.18, issue3, pp.985-999.

Körner, C. (2003): Alpine Plant Life (Springer); 344 p.

Körner, C. (2012): Alpine Treelines (Springer); 220 p.

Körner, C., Paulsen J., Spehn, E.M. (2011): A definition of mountains and their bioclimatic belts for global comparisons of biodiversity data. Alp Bot 121:73-78

Scherrer, D. and C. Körner (2011): Topographically controlled thermal-habitat differentiation buffers alpine plant diversity against climate warming. J Biogeogr 38(2):406-416

Contact

Prof. Christian Körner
Botanisches Institut
Universität Basel
Schönbeinstrasse 6
4056 Basel
Schweiz
Ch.koerner@unibas.ch
http://pages.unibas.ch/botschoen/koerner

Adapting grassland ecosystems to a changing climate

András Báldi
MTA Centre for Ecological Research, Hungary

Europe is largely a human dominated landscape, roughly half of the continent is covered by farmland. The most valuable farmland habitats are the grasslands, harbouring many rare and declining species of Europe. The distribution of farmland biodiversity, however, is not smooth, it depends on biogeographical region, landscape context, local management and their interactions. Extensively managed grasslands may have 10 times more species and individuals in the same taxon than in intensive grasslands, and provide habitat for endangered species like the Great Bustard. Grasslands provide a wide range of ecosystem services, like food provisioning, carbon sequestration, reduction of soil erosion, and provision of cultural values. As the diversity and ecosystem services of grasslands largely depend on management, a pragmatic way is to classify grasslands accordingly into three major types: intensive, extensive and abandoned grasslands. The expected climate change in Europe affects all the three types and related ecosystem services, but different adaptation mechanisms are expected. Intensive grasslands have low biodiversity value, and largely depend on farming practices. Thus, although species poor intensive grasslands probably cannot adapt to climate change, their management by farmers will do adapt, maintaining the crucial food provisioning service. It can be achieved by changing grass type, applying new agrochemicals and farming techniques, etc. Extensive grasslands are semi-natural grasslands, still managed in a traditional way in many areas of Central and Eastern Europe. The adaptation potential of these grasslands is expected to be high, due to the large richness of species with different traits. Here the challenge is to maintain the low intensity management, and also to introduce adaptive management, where – instead of strict EU or national rules – practices more heavily rely on local knowledge and conditions. Abandoned grasslands are threatened by afforestation. These areas will need management, however, here the challenge is to re-start any grassland management, as these are usually low productivity, remote areas. Therefore, to tailor the management to climate change will become important, only if regulations and supports will allow the re-start of management and restoration of the original grassland habitats.

Therefore, adapting grassland ecosystems to climate change depends on both the biodiversity and the farming intensity of the grasslands that is both on natural and societal processes.

- the main role of intensive grasslands is food provisioning, and it is expected that commodity prices and market regulations will maintain it;
- extensive grasslands are species-rich, which is an insurance for adaptation, however, these grasslands heavily depend on low intensity management. This management needs to be fine tuned to the changes in grassland biodiversity;
- abandoned grasslands first of all need management to restore the grassland habitat, and then it can be adapted to the targeted grassland type.

Major policy steps should be to (i) maintain the level of EU's support for nature friendly farmland management, and (ii) to ensure that this large support is used in an effective way (what is not the case in many instances). The latter is especially important for the grasslands with still high biodiversity, as maintenance is always cheaper than restoration.

Contact

András Báldi
MTA Centre for Ecological Research
Alkotmány u. 2-4.
Vácrátót, 2163
Hungary
baldi.andras@okologia.mta.hu

www.okologia.mta.hu

Peatland conservation – Conservation to foster climate mitigation and adaptation

Franziska Tanneberger
University of Greifswald, Germany

Climate change is one of the greatest environmental and political challenges of our time. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007), dangerous global warming cannot be avoided without emission reductions in the land-based sectors. Climate change mitigation thus requires that new emissions from land use change are avoided and management practices of existing production systems are improved. To achieve this 'hotspots' have to be identified where emission reduction can be most effectively realised while taking other important societal goals and environmental services into consideration (Joosten et al. 2012).

Drained peatlands are the prime emission hotspot of the land sector. Peatlands cover only 3% of the world's land area but contain 30% of its soil carbon (Parish et al. 2008). Drainage-based peatland utilization turns the peat soil into a vigorous source of greenhouse gas emissions due to peat oxidization. Peatlands drained for agriculture, livestock grazing and forestry cover merely 0.3% of the world's land area (Joosten 2009), but emit almost 6% of global anthropogenic CO_2 emissions (Joosten 2009, Fig. 1). Unlike the largely instantaneous emissions from forest conversion, the emissions from drained peatlands are persistent and continue for decades and even centuries.

Peatland drainage eventually destroys soil productivity and the provision of many vital ecosystem services. As a rule drainage-based peatland utilisation causes soil degradation and subsidence, eutrophication of ground- and surface waters, and often peatland fires and haze. Peatlands are also critical for biodiversity conservation and play a key role in water regulation while storing a significant proportion of global freshwater.

In Central and Eastern Europe most peatlands have been drained for agriculture (Joosten 2009):

- Germany: drained peatland area 13,000 km^2 with emissions of 32 Mt CO_2 per year
- Poland: 10,200 km^2 with 41.3 Mt CO_2 per year
- Belarus: 18,050 km^2 with 41.3 Mt CO_2 per year
- Russia (European part) 62,600 km^2 with 138.9 Mt CO_2 per year

Globally, this region is the second most important peatland CO_2 emission hotspot after Southeast Asia (Fig. 1) with Russia, Poland, and Belarus ranking among the world's top 10 peatland CO_2 emitters (Joosten 2009). At the same time, due to the immense losses of peatland in Western, West-Central and Southern Europe the undrained peatlands of this region occupy an important 'frontier position' for European biodiversity. Large areas of drained peatland have been rewetted for climate change mitigation and biodiversity protection in recent years, e.g. some 36,000 ha in Belarus (Tanneberger & Wichtmann 2011).

Peatlands offer a huge potential for climate mitigation and adaptation. We must secure that pristine mires remain untouched to prevent their enormous carbon store from being mobilised, and we must restore high water levels in drained peatlands to minimise emissions. Although (re)wet(ted) peatlands are lost for standard agricultural use, they can be used productively. Paludicultures harvest biomass from wet and rewetted peatlands while maintaining the peat body, facilitating peat accumulation and sustaining the ecosystem services associated with natural peatlands. They are increasingly being acknowledged and endorsed by organisations such as FAO (Joosten et al. 2012), IPCC, and the European Union and may add substantially to the substitution of fossil fuels.

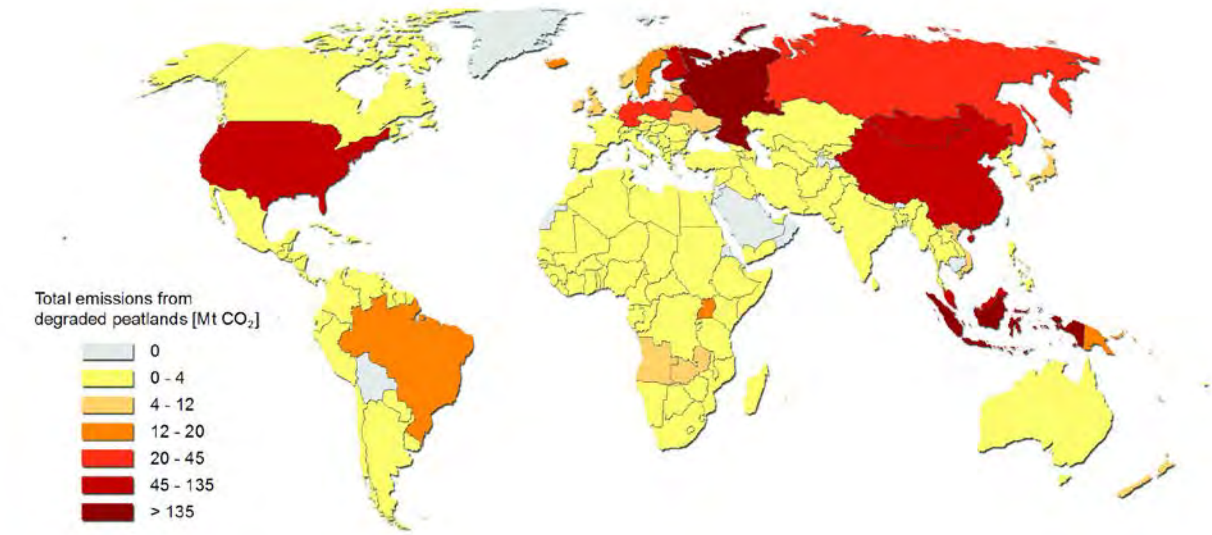


Figure 1: Total annual CO_2 emissions from degraded peatlands (from Tanneberger & Wichtmann 2011).

References

IPCC (2007): Fourth Assessment Report: Climate Change 2007 (AR4) - Synthesis Report. Core Writing Team, Pachauri, R.K. and Reisinger, A. (Eds.) IPCC, Geneva, Switzerland. pp 104

Joosten, H. (2009): The Global Peatland CO2 Picture. Peatland status and emissions in all countries of the World. Ede: Wetlands International. 10 p. (available at: http://tinyurl.com/yaqn5ya)

Joosten, H.; Tapio-Biström, M.-L. & Tol, S. (2012): Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use. Rome: FAO and Wetlands International. 114 p. (available at:
http://www.fao.org/docrep/015/an762e/an762e.pdf)

Parish, F.; Sirin, A.; Charman, D.; Joosten, H.; Minaeva, T. & Silvius, M. (eds) (2008): Assessment on peatlands, biodiversity and climate change. Kuala Lumpur/Wageningen: Global Environment Centre/Wetlands International. 179 p.

Tanneberger, F. & Wichtmann W. (eds) (2011): Carbon credits from peatland rewetting. Climate – biodiversity– land use. Science, policy, implementation and recommendations of a pilot project in Belarus. Stuttgart, Schweizerbart Science Publishers. 223 p.

Contact

Dr Franziska Tanneberger
Greifswald University
Grimmer Str. 88
17487 Greifswald,Germany
tanne@uni-greifswald.de
http://www.botanik.uni-greifswald.de/index.php?id=3528

Climate Change and Mediterranean Coastal Areas: Understanding the Impacts and Developing Adaptation Strategies

Gianluca Sara
Department of Earth and Marine Science, University of Palermo, Italy

On the earth, the best place where to study the possible effects of climate change is doubtless the intertidal ecosystem. Intertidal ecosystems are indeed defined as the benthic marine environments between the high and low tide marks along coastlines. They can vertically extend from a few centimetres (as in the Mediterranean Sea) to several meters (as in most oceanic coasts). Intertidal systems may function as ecological buffers, as in the case of intertidal lagoons and salt marshes, which can reduce coastal eutrophication, provide environmental detoxification and control primary production of adjacent sub-tidal habitats. Intertidal organisms (e.g. macroalgae, mussels, barnacles, limpets, sponges, crabs, fishes and birds) are recognised as important species able to intercept and transform matter and energy flowing from terrestrial environments to the adjacent sea. As a consequence, intertidal ecosystems provide extensive ecosystem services and goods sustaining the well-being and economy of more than 90% of human populations which live in the coastal zone and rely on intertidal resources (e.g. fisheries, salterns, tourism, mining of sediments, harbours).

Despite the many efforts to conserve this important reservoir of biodiversity, the intertidal zone is among the most severely threatened environments on earth. The general understanding of climate change assumes increases in temperature that will affect marine biodiversity on a large scale, and intertidal ecosystems are recognised as those systems where climate change is expected to cause major detrimental effects. Organisms inhabiting unimpacted intertidal live very close to their upper thermal tolerance limits, and have emerged as a powerful bellwether for the effects of climate change on natural ecosystems. Here I propose some case studies developed in a recent EU project (CIRCLE) aiming to study the effects of main climate change drivers on marine ecosystems. I will present some data and the outcome of mechanistic predictions showing how recent advance in ecomechanics modelling can help in the understanding of climate change and to estimate costs of adaption.

Contact

Gianluca Sara
Department of Earth and Marine Science, University of Palermo
gianluca.sara@unipa.it

Urban ecosystems helping cities to adapt to a changing climate

INGO KOWARIK
Department of Ecology, Technische Universität Berlin, Germany
Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB)

Urbanisation strongly increases at a global scale and so does the proportion of people living in cities. More than 50% of the human population is already urban and thus often exposed to stressors of urban environments (thermal pollution, air pollution, noise). Climate change is expected to add significantly on adverse effects, e.g. by amplifying health risks due to urban heat islands.

At the same time, there is a body of evidence of ecosystem services provided by the urban green infrastructure that (i) enhance human health and well-being and (ii) reduce potential costs due to climate change, e.g. by providing access to nature or regulating temperature and stormwater (Hubacek & Kronenberg 2013). Enhancing and valuating urban nature is a major challenge for future urban development, because humans will increasingly depend on urban ecosystem services, and these are progressively more needed in face of climate change.

Yet urbanisation also challenges biodiversity conservation as urban growth usually leads to habitat loss, transformation of historical to novel urban ecosystems and associated turn-over in species assemblages. The resulting high heterogeneity of urban habitats in time and space, however, often leads to surprisingly high species richness, with divergent trends in different groups of taxa (Kowarik 2011). This is not only due to high proportions of nonnative species in urban biota. German cities, for example, are richer in nonnative *and* native plant species than surrounding rural areas (Kühn et al. 2004). This indicates opportunities of biodiversity conservation within urban areas.

While the concept of ecosystem services provides an excellent framework to link biodiversity conservation with the aim of fostering liveable cities, there are some major constraints and related challenges for application:

- Relationship ecosystem services – biodiversity. Given that biodiversity conservation covers all scales from genes to landscapes, most evidence of ecosystem services is restricted to total “nature” or “urban green”, while services related to the species level have been rarely assessed (but see Fuller et al. 2007). Strengthening the latter would strongly support links to conservation.
- Relationship ecosystem services – cultural diversity. Services do not exist in isolation from people’s needs and preferences (Haines-Young & Potschin 2010). Thus, the valuation of services provided by different kinds of urban ecosystems (e.g. traditional parks versus novel urban wildness) is expected to vary broadly among cultural groups. There are thus strong needs to link cultural with biological diversity in approaches to enhance conservation and ecosystem services.
- Relationship ecosystem services – ecosystem novelty. Novel urban ecosystems and associated non-native species are traditionally disregarded by many conservationists. It’s time for a paradigm shift because such ecosystems provide services in the direct vicinity of residents, contribute to biodiversity conservation and show a low vulnerability to climate change due to a high adaptive capacity (Kowarik 2011).

As urbanisation already did in the past, climate change will increasingly affect urban biodiversity patterns in the future. Accepting such changes generally and enhancing biodiversity at all scales within the green infrastructure, and also beyond historical patterns, would help to strengthen links between urban people and nature within liveable cities.

References

Fuller, R.A.; Irvine, K.N.; Devine-Wright, P.; Warren, P.H.; Gaston, K.J. (2007): Psychological benefits of greenspace increase with biodiversity. Biology Letters 3, 390-394.

Hubacek, K. & Kronenberg, J. (2013): Synthesizing different perspectives on the value of urban ecosystem services. Landscape and Urban Planning 109, 1-6.

Haines-Young, R. & Potschin, M. (2010): The links between biodiversity, ecosystem services and human well-being. In: Raffaelli, D.G., Frid, C.L.J. (Eds.): Ecosystem Ecology: a new synthesis, pp. 110–139. BES Ecological Reviews Series, CUP, Cambridge.

Kowarik, I. (2011): Novel urban ecosystems, biodiversity and conservation. Environmental Pollution 159, 1974-1983.

Kühn, I.; Brandl, R.; Klotz, S. (2004): The flora of German cities is naturally species rich. Evolutionary Ecology Research 6, 749-764.

Adapting to climate change in nature conservation in Europe – a survey of conservation projects

Aletta Bonn, Nicholas Macgregor
Freie Universität Berlin, Institut für Biologie, Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), Germany; Natural England, UK

To provide input to the ENCA/BfN conference in June 2013, we conducted a survey of conservation projects across Europe with site managers. The survey's goals were to assess how climate adaptation principles are put into action through planning and measures in conservation sites and focussed on the following issues:

- Impacts of climate change and the perceived temporal relevance of climate change for management of the respective conservation sites
- Integration of climate adaptation into conservation goals
- Management actions and monitoring on their sites
- Information sources and barriers to action.

We received feedback of a total of 72 survey responses from 16 European countries within less than one month, with approximately one third of responses from the UK (25 sites), one third from Germany (26 sites) and 21 responses from sites across 14 other European countries. The feedback reflects in part the focus of the professional networks of the authors, as well as possible language barrier posed by the English and German questionnaire. Most respondents were reserve managers, LIFE project managers or conservation officers in national and regional authorities managing mainly Natura 2000 sites across Europe.

Key messages from the survey results were that conservation managers felt that uncertainty of local impacts of a changing climate on their sites hindered adaptation actions. In addition, climatic impacts were masked by a host of other, more imminent, land use pressures they had to tackle. While some sites, especially national parks with scientific staff, had already prepared detailed vulnerability assessments, the majority of sites did not have any or only a simple vulnerability assessment, owing to either capacity issues or awareness and priority setting in the wider management structure. Therefore climate change adaptation had been considered as central or major factor in the design, planning and management of the site in less than a fifth of all sites. Current adaptation management focused mainly on species and habitat maintenance and restoration, but also on management of natural processes, aiming mainly at a resistance and resilience approaches and less at facilitation of change or transformation. Awareness of impacts of climatic changes was highest for coastal sites, where the need to adapt to change was widely accepted. Most sites with adaptation plans intended to contribute to enhancing ecological networks and connectivity at site and intermediate spatial scales with some coordination between sites. It was interesting to note, that as key sources of information own sites staff and scientists within and outside the respective organisations were mentioned as most influential, whilst published reports, journal papers, modeling results were also important but to a lesser degree.

Barriers to action were mainly knowledge issues with regards to climate change impacts, as well as resource issues with regards to funding, staff ressources and the limited availability of land outside the site. About two thirds of the respondents considered public opinion, the difficulty of taking necessary action outside the site and influencing other sectors as important barriers. Institutional barriers included also contradictory government policies, e.g. towards climate mitigation and adaptation, and in some cases current conservation practices and strategies, which may not be geared towards adaptive management in a changing climate. To foster climate change adaptation in European nature conservation, it may therefore be useful to build capacity within and between sites through working actively with conservation managers and enabling meaningful exchange of knowledge and experience.

Contact

Aletta Bonn
Freie Universität Berlin
Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB)
Institute of Biology
Königin-Luise-Str. 1-3
14195 Berlin
Germany
aletta.bonn@fu-berlin.de

Payments for ecosystem services: options for financing climate change adaptation

Mark Reed
University of Bimingham, UK

Society values the natural environment for climate regulation, provision of clean water and recreational/health benefits, and yet society does not typically pay land managers to provide many of these benefits, leading to management for short to medium term direct benefits that sometimes leads to environmental degradation. Broadly speaking there are five types of policy instrument available to resolve this conflict of interests: nationalisation of land; information provision and capacity building; regulation; financial mechanisms e.g. taxes and incentives; and the creation of new markets to pay for ecosystem services. With the exception of nationalizing land, a mix of most of these instruments is already being used in most countries to differing extents.

Work funded by the UK Government has identified a number of barriers to these new markets, including: scientific uncertainty; spatial variability in service provision; time lags and time horizons over which services are provided; challenges in valuation; legal and policy environment; and guaranteeing permanence and additionality. Opportunities centred around paying for water quality, flood risk alleviation, climate regulation and cultural services such as recreational and health benefits from nature. Based on this work, we developed a Payment for Ecosystem Service Best Practice Guide and have devised a UK Peatland Code to stimulate private investment in the climate regulation, water quality and biodiversity benefits of peatland restoration.

Although many investors are primarily motivated by the climate mitigation potential of these schemes, the adaptation benefits are also a major selling point – a restored peat bog can enable important species and habitats to continue thriving for far longer in the face of climate change than a degraded bog. Perhaps through initiatives like this, we might all be able to start sharing responsibility for the state of nature that we're in – government, business and public working together to get a better balance of benefits from the way we use our land.

Water Framework Directive – policy coherence as a key factor for improved water management and nature conservation in a changing climate

Michael Bender
GRÜNE LIGA e.V.
Bundeskontaktstelle Wasser / Water Policy Office, Germany

EU Member states must achieve good ecological status of lakes, rivers, transitional and costal waters by 2015 (Article 4 WFD). They have to prevent deterioration and restore all water bodies for good status. The competent water authorities provide for a set of measures to be taken to achieve the objective. This concept did not work out in the first planning cycle. The European Environmental Bureau (EEB) together with WWF came up with a set of five priorities for better water management:

- Transparent and publicly owned water management
- Reducing wastage and using water well
- More space for living rivers
- Healthy, safe water for people and nature
- Visionary and adaptive water policies

These priorities are suitable for political messages. To combine water policy, nature conservation and flood risk protection more space for living rivers is the right message. The GRÜNE LIGA e.V. Water Policy Office examined all German river basin management plans to investigate to which extend economic instruments of the Water Framework Directive have been used to support the achievement of good status. The use of economic instruments in this analysis is also taken as an indicator for the degree of coherence in European policies and thus also takes components into account that are not explicitly mentioned in the Water Framework Directive itself[1].

In general it can be stated that the economic analyses, which were carried out in 2005 did neither provide sufficient information to assess the economic relevance of water uses nor did they reflect the pressures and impacts of the economic activities on the waterbodies.

Heavily modified water bodies and exemptions

Heavily modified (and artificial) water bodies (HMWB) mark the most widely used exemption from the objective of good ecological status in the German River Basin Management Plans (*RBMPs*). There has been an identification of HMWBs that is connected to the good status objective which is by definition a lower objective than the good status objective.

Most federal states simply list very generally those uses of the water body whose *mere existence* justified designation as an HMWB. The designation test that is foreseen under article 4 WFD and specified in the HMWB guidance (step 7 and 8) has not been carried out properly for most water bodies throughout Germany.

Conclusions of GRÜNE LIGA

It can be assumed that by designating a water body as „heavily modified“ and „artificial“ there has been almost no serious assessment of the economic criteria as required by the WFD! This is a striking contravention of the directive‘s requirements.

[1] The complete analyses has been published in http://www.wrrl-info.de/docs/brosch_en_web.pdf

Thus, a reassessment of HMWB designation must be carried out as a matter of urgency. Where there has been recourse to deadline extensions and less stringent environmental objectives, disproportionate costs must be discussed in a more precise manner than has hitherto been the case in the RBMPs.

Heavily modified water bodies – Inland navigation case

Classification „Bundeswasserstraße“ (navigation route of national interest) does not necessarily mean heavily modified or artificial water body. Current discussion on national waterways:

- Upgrade and maintenance priorities
- Tourism
- Elbe no longer included in TEN-Projects

After about 20 years of discussion the ministry of transport reconsidered infrastructure investments in inland navigation according to actual transported volume of goods. With WFD NGO's can challenge those projects also with respect to their lack of socio-economic benefits. Compliance with article 4.7 WFD (no deterioration) must be a prerequisite for any new navigation infrastructure development, hydropower and dam project. So far not a single deterioration case is reflected in the German RBMP's.

Excursus:

Is building new large dams a sustainable solution for climate change mitigation? Problems connected to building large dams like:

- interruptiing biological continuity & change of habitats leading to the loss of migratory fish population like eel and salmon
- violating human rights led to World Commission on Dams (WCD) risks and rights based approach.

With its final report, the WCD fulfilled its mandate to establish internationally acceptable criteria, guidelines and standards for the planning, design, appraisal, construction, operating, monitoring and decommissioning of dams.

Just one detail that is currently underestimated: sedimentation

Sediments trapped behind dams not only impair the functioning of reservoirs, but are also missing downstream, resulting in increased erosion of river beds and deltas. The WCD estimates that 1% of reservoir storage capacity is lost per year.

Since the early 1990s, the loss of reservoir space through sedimentation exceeds the storage capacity of newly built dams. Projected dams are not even able to compensate the loss of reservoir volume through sedimentation. 20% of all reservoirs will be inoperable by 2015 based on data from Jenzerand Cesare (2005) and GWSP Digital Water Atlas (2008), Map 51: Sediment Trapping by Large Dams (V1.0), available online at http://atlas.gwsp.org. Image from „Water for Life“, GRÜNE LIGA, 2011.

Polluter pays principle and principle of cost recovery

The polluter pays principle and the principle of cost recovery is set forth in article 9 WFD. In view of its impreciseness and the dispute surrounding the meaning of article 9, it should be remembered that the „polluter pays“ principle and the principle of cost recovery has been anchored in German water management and environmental policy for many years.

However, the use of these two principles ranges from nearly full application to no inclusion and anywhere in between, depending on the water use. A more systematic application for all water uses is called for.

GRÜNE LIGA recommendation

Apply the polluter pays principle more consistently: oblige energy producers, mining companies, agricultural business and other intensive water users to pay adequate contributions to the recovery of costs.

Water prices and water abstraction fees

Quantity-dependent water prices for public water supply in Germany, which by and large recover costs, have been a successful model – also when compared to other EU countries – and have led to a significant reduction in drinking water consumption since 1990. The incentive effect of this pricing structure should not be carelessly put at risk. They can be seen as a role model for water scarce areas and be more widely used throughout Europe. Instead, the objective should be to transfer the effective incentives of quantity-dependent prices that recover costs to other water abstractions and uses. Water abstraction fees have recently been introduced in the German federal states of Rhineland-Palatine and Saxony-Anhalt.

Internalisation of environmental and resource costs

Example from the policy paper: Lack of water abstraction taxes for mining and energy production. Mining and energy production are by and large exempt from a duty to pay in all federal states where a tax or fee is levied on water abstraction. In future, the full rates for water abstraction charges should be applied in particular to these sectors as their water uses are associated with high external costs. Thermal power stations – which abstract 20.1 billion m^3 (2007) of water annually – represent the largest national water users across Germany. Coal mining alone requires about 800 million m^3 additional freshwater. The long-term negative implications are clear from the decision to set less stringent environmental objectives (according to article 4 paragraph 5 WFD) for nine groundwater bodies in the German Elbe river basin that are affected by mining because it will not be possible to achieve a good status even by 2027. Yet there have not even been rudimentary calculations in the river basin management plans nor in the economic analysis which allow the enormous costs of mining and cooling water usage to be quantified.There is some progress, however! A full water abstraction tax for open pit coal mining has been introduced in the German federal state of North-Rhine Westphalia in 2011.

Conclusions of GRÜNE LIGA

Water abstraction taxes and the wastewater tax are currently the most important instruments for allocating environmental and resource costs to polluters in Germany. The national wastewater tax should be retained but reformed according to currently relevant parameters. Introduction of water abstraction taxes in all federal states and the expansion of the scope of these usage-linked taxes is a matter of urgency.

There is still a great deal of leeway to (re)design water abstraction taxes in a sensible manner from an ecological and environmental perspective at state level. This room to manoeuvre should be used promptly in order to achieve the environmental objectives of the WFD. In accordance with article 9 WFD, 2010 would have been a good time for this.

There is a particularly urgent need for far-reaching exemptions, such as for mining and energy production, as well as agriculture, to be removed since these act as subsidies that cause considerable environmental damage.

In essence, failure to remove unreasonable privileges for individual groups of users is down to a lack of political will.

Harmful subsidies

There has been no reassessment or reversal of subsidies for ecologically harmful water uses by agriculture, inland navigation, energy production, flood protection, tourism, etc. in the RBMPs.

Conclusions of GRÜNE LIGA

The large number of ecologically harmful subsidies should be evaluated comprehensively in terms of their extent and their impact on water resources.

It is necessary to take corrective action for subsidy policy, particularly in the area of agricultural funding, and this must take priority over the deployment of additional grants and funding.

Harmful subsidies – Common Agricultural Policy (CAP)

Water related EEB & GRÜNE LIGA recommendations for CAP-reform:

1. ENSURE STRICT ENVIRONMENTAL OBLIGATIONS IN PILLAR 1 AS FROM JANUARY 1ST 2014:

No direct payments to farmers without strict cross compliance including environmental standards based on the Water Framework Directive and binding obligations for water metering, nutrient balancing, pesticide application and erosion control.

The following short-list of basic measures to be included into the scope of cross compliance was agreed on by the Common Implementation Strategy Expert Group on Water Framework Directive and Agriculture in October 2012. They are readily applicable and compulsory for farmers, they need to become cross compliance provisions by January 1, 2014:

1. Respecting Compliance with the authorisation for water abstraction (WFD art. 11.3.e).
2. Respecting Compliance with the authorisation for the creation of an impoundment that affects a water body or a riparian area (WFD art. 11.3.e)
3. Respecting requirements for water metering as implemented by Member States (WFD art. 11.3.b).
4. Respecting the prior authorisation for the modification of riparian areas and the requirement for restoration of riparian areas as implemented in the Member States (WFD art. 11.3.i).
5. Respecting mandatory requirements to control diffuse sources of pollution by phosphates as implemented in the Member States (WFD art. 11.3.h).
6. Respecting requirements for slurry storage and spreading outside of Nitrogen Vulnerable Zones, to reduce diffuse pollution of nutrients and minimise organic pollution as implemented in the Member States (WFD art. 11.3.h).

Note that WFD article 11 lists basic measures as “minimum requirements to be met” in every river basin management plan.

2. INTEGRATE 10% ECOLOGICAL FOCUS AREAS ON AGRICULURAL LANDS (COMPULSORY AT FARM LEVEL) FOR WATER, SOIL AND BIODIVERSITY IMPROVEMENT:

Mitigate nutrient and pesticide effects from agricultural and improve water rural runoff dependent ecosystems with buffer strips, wetlands and riparian zones along all water courses, ditches, ponds and lakes.

3. SECURE SUFFICIENT FUNDING BY EARMARKING 50% FOR AGRI-ENVIRONMENTAL MEASURES, COMPENSATION PAYMENTS RELATED TO WATER FRAMEWORK DIRECTIVE AND NATURA 2000 AND ORGANIC AGRICULTURE IN A STRONG PILLAR 2 FOR SUSTAINABLE RURAL DEVELOPMENT:

Support real environmental improvements through rehabilitation of wetlands, floodplains and riparian habitats, through land use adapted to natural water dynamics such as paludiculture and extensive grazing in floodplains, and through water friendly farming through organic agriculture.

The Baltic Sea Case – use restored wetlands to reduce nutrient input

Eutrophication is, along with overfishing, the most severe environmental problem of the Baltic Sea. Baltic rivers carry large amounts of nutrients. About 70% of the nitrogen and 44% of the phosphorus inputs originate from diffuse sources, mainly from agricultural lands. The resulting eutrophication of coastal and marine waters leads to algal blooms which deteriorate marine habitats through drastically decreased water transparency and oxygen depletion. The HELCOM Baltic Sea Action states the goal of "a Baltic Sea unaffected by eutrophication" and addresses the need for action in its „clear water" objective.

In the context of river basin management for Baltic Sea tributaries, wetlands can play an important role in reducing diffuse nutrient inputs from agriculture. This is reflected in many water and marine protection policies, from the Water Framework Directive (WFD) to the HELCOM Baltic Sea Action Plan to – most recently – the EU Strategy for the Baltic Sea Region.

But although wetland management is part of several policies, it is not sufficiently addressed on a strategic level, e.g. in the Baltic Sea catchment river basin management plans.

GRÜNE LIGA conclusions from the Conference Wetlands for Clear Water, held in Greifswald, on 24-25 March 2013:

1. Wetlands are indispensible for nutrient reduction in the Baltic Sea
2. Wetland measures need clear priorities
3. Wetland strategies need a policy mix to be effective
4. Integrate wetlands strategies in river basin management planning!
5. Make use of the high cost-effectiveness of wetlands!
6. Factor in the wider environmental benefits of wetlands!
7. Adapt and redesign agricultural policies for better wetland management!
8. Learning from Sweden: Integrate wetlands in the agricultural landscape!
9. Make use of existing "ecohydrological" planning and management tools!
10. Support wetland strategies with economic instruments!
11. Better wetland management needs communication and information

Drained wetlands significantly contribute to greenhouse gas emissions

Drainage, degradation and unadapted management of wetlands continue to cause significant harm to the Baltic Sea. More than 90% of all fens in the region were transformed into agricultural lands that emit large quantities of nutrients and to emissions of carbon dioxide and laughing gas (nitrous oxide).

Harmful subsidies – biomass

Additional pressure on water resources is caused by the massive increase in public money spent on biomass payments in the context of renewable energies policies. Truly alarming developments can be observed in Germany. Artificially created high returns of biomass production, mostly maize and rapeseed, have led to drastic increases of the price for agricultural land. Investments in these lands compete with agricultural use for food production. In light of the low net renewable energy gain of biomass production through conventional farming, these production schemes need much stricter environmental criteria.

As of 2011, approximately 17% of all arable land in Germany was used for biomass production (2 million hectares). Particularly the increase in maize production has in many areas resulted in a significant deterioration of the status of Germany's waters. The modest success of agri-environmental schemes and other measures that had been achieved in reducing eutrophicaton are literally overrun by these developments.

From official estimates it can be clearly concluded that with current impacts, the environmental goals of the Water Framework Directive and the Marine Strategy Framework Directive will not be achieved in any of the groundwater bodies classified in bad status in 2009, in all coastal and marine waters (Baltic Sea and North Sea), as well as in most rivers and lakes e.g. in the federal state of Schleswig-Holstein.

But „Who cares about water???" Sometimes people do! In Berlin - our Water: Unser-Wasser-Peoples initiative in Berlin with 280,887 valid signatures lead to some improvements in transparency. 678,507 people voted for the publication of the treaties that where concluded during the part privatisation of Berlin Water- and Sewage Works on the first successful public referendum in Berlin on 13 February 2011 an incredible share of 98.2 percent of the votes!

In Germany and in Europe

Can we do it? Yes we can! The European Citizens Initiative „Water and sanitation are a human right! Water is a public good, not a commercial product!!" has been signed by 1.65 Million European Citizens thus making it the first successful European citizens initiative ever (numbers as per 16 June 2013).

Background Information can be found in our policy papers and newsletters:

- Economic Instruments in the Water Framework Directive: An Opportunity for Water Protection. Shortcomings in the First Management Cycle and the Need for Action. Policy Paper from GRÜNE LIGA e.V. on the German River Basin Management Plans, Berlin, 2011. http://www.wrrl-info.de/docs/brosch_en_web.pdf
- GRÜNE LIGA (2011): Wetlands for Clear Water; www.wrrl-info.de/en/docs/wrrl-sonderinfo_en.pdf
- Water for Life. GRÜNE LIGA Policy Paper on the UN Water for Life decade and the Water, Energy and Food Security Nexus GRÜNE LIGA (2011). www.wrrl-info.de/docs/positionspapier_water_%20for_life.pdf
- EU COMMON AGRICULTURAL POLICY 2014–2020: CAP-REFORM MUST DELIVER TO SAFEGUARD EUROPE'S WATERS! *GRÜNE LIGA and EEB December 2012; © 2012 European Environmental Bureau (EEB).* www.wrrl-info.de/docs/material_CAP_reform_safeguard_water.pdf
- THE EEB'S MAIN PRIORITIES ON THE BLUEPRINT TO SAFEGUARD EUROPE'S WATER RESOURCES, GRÜNE LIGA and EEB, October 2012.

Contact

Michael Bender, Tobias Schäfer, Alexandra Gaulke
GRÜNE LIGA e.V.
Bundeskontaktstelle Wasser
Greifswalder Straße 4
Berlin 10405
Germany
wasser@grueneliga.de

www.wrrl-info.de

Identifying spatial priorities for adaptation action in the Welsh landscape

Clive Walmsley, Rob McCall, Tim Pagella, Robert Deane
Natural Resources Wales, Bangor University and LUC, UK

Within Wales some 12% of the land area is designated for its nature conservation interest and if landscape designations are added a total of 24% has some protected status. Natural Resources Wales (formerly Countryside Council for Wales) have already undertaken a Wales-wide vulnerability assessment for all designated nature conservation sites, which has helped identify those where the risk of significant impacts over the next 20 years are high (Wilson et al. 2013). This has been based on assessment of the sensitivity of the habitat or species features to climate, the degree of other sources of harm, current habitat condition and site connectivity. Building upon previous attempts to develop an adaptive management approach that considers climate change impact-risk, such as the assessment undertaken for the Bosherston Lakes SAC (Holman et al. 2009), this vulnerability assessment has allowed us to identify priority sites for future adaptation measures. However, this work will not address the majority of Wales that lies outside of any protected area. Given that there are many areas of High Nature Value outside of the protected areas, there is a strong case to consider the potential for adaptation within the landscape more widely.

Natural Resources Wales is a partner within the Cambrian Mountains Initiative (http://cambrianmountains.co.uk/) which seeks to enable sustainable development of local tourism, farming and communities whilst maintaining the valuable ecosystems and habitats and the provision of ecosystem services in the area. As part of the Initiative, NRW, Bangor University and LUC sought to identify opportunities for enhancing environmental resilience to climate change for biodiversity and other ecosystem services within part of the Cambrian Mountains. More explicitly the project posed the question, can we apply biodiversity adaptation principles (such as those set out by the UK Biodiversity Partnership; Hopkins et al. 2007) at a landscape scale, while maintaining or enhancing other ecosystem services?

To answer this question a GIS decision support tool (Polyscape) that applies user-defined rules to identify areas where there are opportunities for land use change as well as where land use should be maintained or enhanced was used to determine spatial priority areas for biodiversity conservation, agricultural productivity, flood risk management and carbon storage adaptation scenario layers. A combined layer that identified areas where land use change could deliver multiple benefits was derived using an additive approach. Additional expert opinion and local knowledge was sought to refine the inputs and the rules for each layer. Google Earth was used to visualise areas of potential land use change and engage landowners and other stakeholders in a conversation to determine the validity and feasibility of such adaptation measures. The outputs identified broadleaved woodland and bog/peatland as priorities for protection. The areas providing most opportunity for change were within the step-sloped ‘ffridd’ zone at the interface between lowland and upland while lowland agricultural areas provide moderate potential for change (LUC 2011).

The process of devising rules within layers was instructive in itself, especially with the use of Google Earth to stimulate debate. In general, stakeholders appreciate the integration of different agendas and the identification of both win-win and conflict areas so as to help explore their resolution. However, the support tool is reliant on the quality of the underlying data, with significant potential for improvements and the simple arithmetic approach to combining layers could be refined further. It is important to appreciate that the process identifies potential for land use change that could provide adaptation benefit rather than land management changes. The project has helped establish a community of engaged landowners and communities that will be involved further in exploring the potential for adaptation delivery. This can be facilitated through both their inclusion within the Welsh agri-environment scheme prescriptions and exploring potential for a Payment for Ecosystem Services approach in the Cambrian Mountains. The work has also provided further evidence for greater recognition of the importance of the ‘ffridd’ zone as a habitat of conservation importance.

References

Holman, I.P.; Davidson, T.; Burgess, A.; Kelly, A.; Eaton J. & Hatton-Ellis, T.W. (2009): *Understanding the effects of coming environmental change on Bosherston Lakes as a basis for a sustainable conservation management strategy*. CCW Contract Science Report No. 858. Countryside Council for Wales, Bangor.

Hopkins, J.J.; Allison, H.M.; Walmsley, C.A.; Gaywood, M. & Thurgate, G. (2007): *Conserving biodiversity in a changing climate: guidance on building capacity to adapt*. UK Biodiversity Partnership. Defra, London.

LUC (2011): *Cambrian Mountains Adaptive Landscapes Project. Summary report*. Land Use Consultants, Bristol.

Wilson, L.; McCall, R.; Astbury, S.; Bhogal, A. & Walmsley, C.A. (2013): *Climate Vulnerability Assessment of Designated Sites in Wales*. CCW Contract Science Report No. 1017. Countryside Council for Wales, Bangor.

Contact

Dr Clive Walmsley
Natural Resources Wales
Maes-Y-Ffynnon
Bangor
LL57 2DW
UK
clive.walmsley@naturalresourceswales.gov.uk
www.naturalresourceswales.gov.uk

4.5 Interactive Session I: Mountain & subarctic ecosystems

Climate change in Bucegi mountain – Natura 2000 habitats sensitivity

ANCA SÂRBU, GEORG JANAUER, IRIS WAGNER-LÜCKER
Department of Botany-Microbiology, University of Bucharest, Bucureşti, România
Department of Limnology, University of Vienna, Vienna, Austria
Department of Conservation Biology, Vegetation and Landscape Ecology, University of Vienna, Vienna Austria

Climate change (CC) is an important threat to the natural environment, significantly impacting flora and habitats in protected areas (Araújo et al. 2011). Management adaptation to CC and mitigation measures in nature conservation receive increasing attention (Campbell et al. 2009) and need documentation of the sensitivity of ecological systems to actual and long-term climatic pressures.

This contribution provides information about the sensitivity of protected habitats from high mountain areas, and the magnitude of potential CC impact expected. It addresses Bucegi Natural Park (part of Bucegi Natura 2000 site), a cold and humid mountain area of 32,497.6 ha (Southern Carpathians, Romania) and provides information on climatic sensitivity and potential vulnerability of Natura 2000 habitats of alpine scrub (code: 4070*), grasslands (code: 6150, 6230*) and forests (code: 9110, 91V0, 9410). Temperature and moisture values were selected as climatic, and edaphic, indicator parameters. Sensitivity of habitats was evaluated by two approaches: i) regional expert knowledge (Petermann et al. 2007) and ii) assessment of current plant community structure and species indicator values with respect to temperature and moisture (Ellenberg 1992, Popescu & Sanda 1998). Evaluation adopted a three level scale: low, medium and high sensitivity. Sensitivity related to moisture was high for forest and medium for scrub and grassland habitats. Sensitivity for temperature was high for scrub habitats and also for grasslands habitats, but medium for forest habitats.

For assessing potential CC impact (three levels: low, medium, high), we considered the magnitude of exposure (climatic water balance and temperature mean), the sensitivity to moisture and temperature and information about regional sensitivity. According to climate scenarios developed for the HABIT-CHANGE project, warmer and drier conditions are projected for Bucegi Natural Park: i) a clear temperature rise during summer (with 2-3°C) up to the end of this century, ii) a significant decrease in precipitation after the year 2040, iii) the reduction of the climatic water balance after the middle of this country. The impact of CC was determined as medium for grassland habitats and as high for scrub and forest habitats in Bucegi Natural Park. Temperature increase can be considered the significant climatic pressure for alpine and subalpine habitats, and the decrease in moisture for mountain forests.

Two sensitivity maps highlight sensitivity for all habitats, a potential impact map predicts the effect of temperature and moisture changes, and a scenario map relates to the amplitude of CC consequences that may occur.

Acknowledgements

Results relate to "HABIT-CHANGE: Adaptive management of climate induced changes of habitat diversity in protected areas" (CENTRAL EUROPE Program, co-financed by ERDF).

References

Araújo, M.B.; Alagador, D.; Cabeza, M.; Nogués-Bravo, D. & Thuiller, W. (2011): Climate change threatens European conservation areas. Ecology Letters, 14(5), 484-492.

Campbell, A.; Kapos, V.; Scharlemann, J.P.W.; Bubb, P.; Chenery, A.; Coad, L.; Dickson, B.; Doswald, N.; Khan, M.S.I.; Kershaw, F. and Rashid, M. (2009): Links between Biodiversity and climate Change: Impacts, Adaptation and Mitigation (Review). Secretariat of the Convention on Biological Diversity, Montreal, Technical series No 42, 124 pp.

Ellenberg, H.; Weber, H.E.; Düll, R.; Wirth, V.; Werner, W.; Paulißen, D. (1992): Zeigerwerte von Pflanzen in Mitteleuropa. Scripta Geobotanica 18 (2. Auflage 1992).

Petermann, J.; Balzer, S.; Elwanger, G.; Schröder, E.; Ssymank, A. (2007): Klimawandel – Herausforderung für das europaweite Schutzgebietssystem Natura 2000. Naturschutz und Biologische Vielfalt, 46, 127-148. Bundesamt für Naturschutz, Bonn.

Popescu, A. & Sanda, V. (1998): Conspectul florei cormofitelor spontane din România. Acta Botanica Horti Bucurestiensis, /1998/, 3-336.

Contact

Anca Sârbu
Department of Botany-Microbiology, University of Bucharest
Aleea Portocalelor 1-3
Bucharest, 060101
Romania
anchusa24@yahoo.com

Peatlands in the Arctic – the global value of ecosystem services

Minayeva, T.; Bragg, O.M.; Kershaw, G.P.; Sirin, A.
Wetlands International; University of Dundee, Scotland, UK; Department of Earth & Atmospheric Sciences (retired), University of Alberta, Edmonton, AB, Canada; Institute of Forest Science, Russian Academy of Sciences, Moscow, Russia.

The dominant terrestrial ecosystems of the Arctic are wetlands, mostly peatlands (Minayeva & Sirin 2009). They typically occupy river valleys (modern and ancient), drained lakes (hasyry), thermokarst lakes (allases), thermokarst depressions (sedge fens), flat watersheds (polygon and palsa mires) and flat seashores in estuaries and bays (freshwater and brackish marshes); but the most extensive peatland is shallow peat tundra covering gently sloping watersheds and terraces. Most “tundra” ecosystems have a peat layer 5–80 cm thick, which is crucial for thermal isolation of permafrost, preventing it from thawing and thus maintaining landscape structure.

Arctic peatlands provide a range of ecosystem services including crucial regulation functions. Their origins and hydrology are highly dependent on permafrost, and they maintain a singular hydrological regime upon which arctic ecosystems depend. They also maintain one of the world’s largest carbon pools in the peat, underlying soils and bedrock. Because the current climate does not support such intensive peat accumulation as previously occurred during the Atlantic period of the Holocene, the importance of the carbon storage role of arctic peatlands currently exceeds that of their carbon accumulation capability.

Arctic peatlands support species biodiversity by providing permanent habitats for many species and by meeting the shifting requirements of migratory birds during different phases of their seasonal cycles. Because major bird migration flyways converge on the Arctic, arctic peatlands support avian biodiversity worldwide. They also play a major role in supporting the traditional lifestyles and livelihoods of indigenous people.

Rapid industrial development and intensification of “traditional” arctic land uses bring requirements for new infrastructure such as roads, pipelines, construction plots and bridges; and permanently increase the presence of people in the landscape. A particular problem is frequent illegal use of vehicles off-road in summer, which directly damages the peat layer and consequently promotes the loss of permafrost.

Estimates based on remote sensing data show that the fraction of total land area now covered by linear and plot infrastructure ranges from 0.1% in Nenetsky AO (European Russia) to 3% in Yamalo-Nenetsky AO (northern West Siberia). In absolute figures, this amounts to several thousand square kilometres in the Russian Arctic alone. A linear construction usually influences more than 10 times its direct footprint area, so we can expect much more extensive secondary effects.

This course of human development exacerbates climate-change effects through land degradation, accelerated thawing of permafrost, and increased methane emissions from soils and permafrost; together with irreversible peat loss by decomposition and as particulate and dissolved organic matter, which in turn leads to water pollution and ocean acidification. Unfortunately, there is a significant knowledge gap; qualitative descriptions of the processes are available but there are few published data to enable quantification (Minayeva & Sirin 2010).

Due to the lack of scientific background, peatland conservation and ecosystem management needs are inadequately served by present provisions for governance of the Arctic.

Moreover, the climate-change implications of this type of land use change are not taken into consideration, and are not yet included in UNFCCC discussions or the IPCC research dialogue. Because extractive industries are becoming the main arctic land users, the problem should be addressed at the level of corporate rules, and in national and international legislation, before the existing inadequate land use regulations are integrated into practice to such a degree that they become unchangeable.

At the request of Shell, the authors of this presentation compiled a report on the status of arctic wetlands, key aspects of the oil and gas industry footprint, and the potential for mitigation (Kershaw et al. 2012). Information from this report was used, in co-operation with Shell and other companies, to develop pilot projects demonstrating how industry might adopt the ecosystem approach when applying mitigation hierarchy principles. The GEF funded UNDP project “Mainstreaming biodiversity conservation into Russia’s energy sector policies and operations” opens up new possibilities for bringing this approach into corporate practice, as well as into national and international legislation.

References

Kershaw, P.; Sirin, A.; Bragg O.; Minayeva T. (2012) (eds.): Oil and gas industry impact on arctic wetlands, mitigation, recovery and restoration options. Final report. Wetlands International, Ede, 2012. 184 pp.

Minayeva, T. & Sirin, A. (2009): “Wetlands - threatened arctic ecosystems: vulnerability to climate change and adaptation options” // UNESCO publication “Climate change and Arctic sustainable development. Section 2 – Biodiversity and ecosystem services”, pp 76–83.

Minayeva, T. & Sirin, A. (2010): Arctic peatlands in: Arctic Biodiversity Trends 2010 – Selected indicators of change. CAFF International Secretariat, Akureyri, Iceland. May 2010. 71–74.

http://www.arcticbiodiversity.is/images/stories/report/pdf/Arctic_Biodiversity_Trends_Report_2010.pdf

Contact

Tatiana Minayeva
Wetlands International
P.O. Box 471
Wageningen, 6700 AL
The Netherlands
tatiana.minaeva@wetlands.org
www.wetlands.org

National Parks as outdoor laboratories for climate change impact

HELMUT FRANZ & MICHAEL VOGEL
Berchtesgaden National Park, Germany

Principles

The National Park of Berchtesgaden is the only alpine National Park in Germany. It aims to protect nature, supports environmental education and long term ecological research. It implements a methodology for long term observation of plant and animal communities. These objectives are imposed by a regulation of the Bavarian parliament (cf StMLU 2001).

The whole area of the National Park is monitored by color-infrared aerial photos since 1980. Seven aerial photo generations exist at present. Change detection of land cover types is worked out on this base for four aerial photo generations. This is the backbone for all other monitoring programs in the National Park.

Monitoring programs with reference to climate change

For the time period between 1985 and 2005 a subset of 60 areas above 2,000 m a.s.l. out of a total of 3,000 phytosociological inventory plots was analysed. A shift of plant species was diagnosed. The plant species number increased between 25 and 40% caused by climate change. Other potential impacts are not relevant in this place in the core zone of the national park, except input of nitrogen, which is analysed at present.

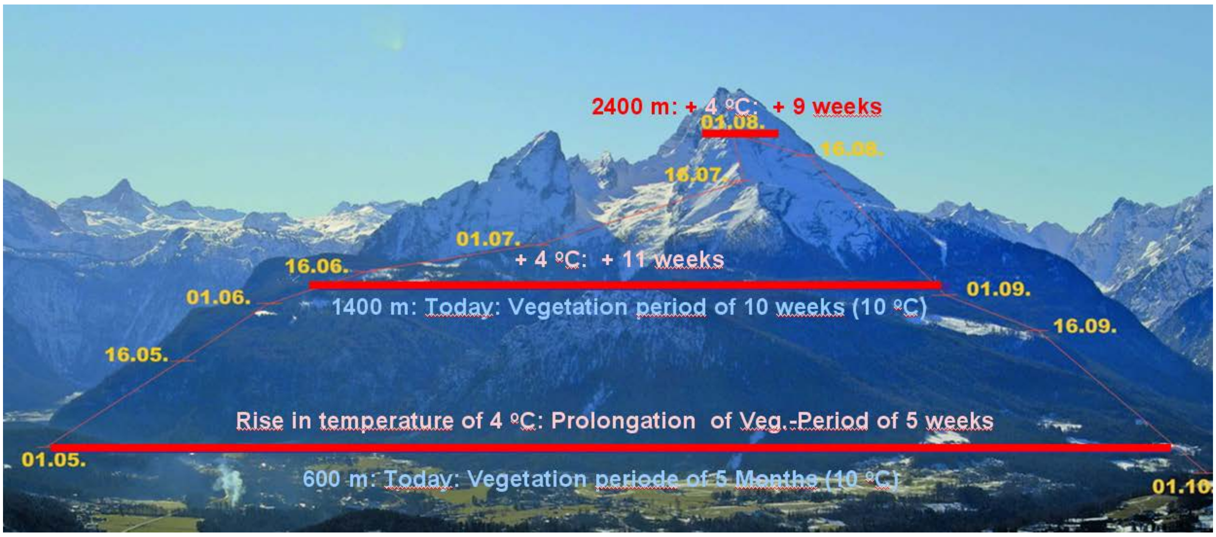
The data of the phenological observation monitoring program in an altitude between 700 and 1,400 m a.s.l. were checked last year. A significant difference in sensitivity to temperature change was found between different growth forms of herbs vs. trees. For some species the lengths of leafing and flowering periods changed with increasing altitude.

The National Park of Berchtesgaden is part of the worldwide GLORIA – Network, which detects impact of climate change on mountain peak vegetation with standardized methods. A spring monitoring shows faunistic differences of springs situated at low and medium elevation in forest regions and springs above timberline.

Thirty years ago, about 20 vegetation fences were established. They monitor the impact of game browsing on trees and herbaceous vegetation by mapping plant species. After thirty year of data analysis, we could work out an impact of temperature increase on these areas. The temperature indicator increased for all these monitoring places. At present, we try to separate the impact of forest development phases from the impact of climate change.

Backbone of climate change documentation and water balance model

The network of 15 automatic meteorological stations from the valley to the peaks of the mountains is the backbone of climate change documentation. Based on the results for the climate data recording of 20 years, we identified the present vegetation period and the supposed change of vegetation period with a supposed average increase of 4°C:



Based on the climate data records, we established a water balance model for one scenario of IPCC with following results for the national park and its surrounding area for the control period of 1971-2000 and the scenario period of 2021-2050. Based on this scenario, the average air temperature should increase with 1°C, rainfall should increase for 25 mm, snowfall should decrease for 51 mm and snow cover should decrease for 19 days (Kraller et al. 2012).

Outlook

These data sets will support the habitat suitability and habitat shift on a microscale, not only for the national park, but also as a cornerstone in a wider area. Thus, the national park research and long term monitoring could lay down, which of the proposed scenarios of the IPCC will come true and if the measures, that have been carried out due to climate change, will succeed for the area of the national park as an indicator for the whole region, at least in the alpine environment.

References

Franz, H.; Baier, R.; Gerecke, R.; Grab, J.; Hofmann, G.; Huber, D.; Konnert, V.; Kraller, G.; Kunstmann, H.; Künzl, M.; Lotz, A.; Strasser, U.; Vogel, M. & M. Warscher (2011): Implementing the GLOCHAMORE Research strategy into the Biosphere Reserve Berchtesgadener Land. Global change in Mountain Regions (GLOCHAMORE) A Project of the UNESCO's Man and Biosphere Programme. In: http://unesdoc.unesco.org/images/0021/002146/214657E.pdf

Kraller, G.; Warscher, M.; Vogl, S.; Marke, T.; Strasser, U. & H. Kunstmann (2012): Water balance estimation in high Alpine terrain by combining distributed modelling and a neural network approach (Berchtesgaden Alps, Germany), in: Hydrology and Earth System Sciences 16, 1969 - 1990, 31 S.

StMLU (Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen) (Hrsg) (2001): Nationalparkplan. Nationalpark Berchtesgaden. 202 S. (cf. http://www.nationalparkplan.de)

Contact

Helmut Franz & Michael Vogel
Berchtesgaden National Park
Doktorberg 6
83471 Berchtesgaden
Germany

Farming with Alternative Pollinators (FAP) – an indispensable method to protect biodiversity and livelihoods in mountainous regions in the course of climate change

Stefanie Christmann, Aden Aw-Hassan
Environmental Governance, ICARDA, Uzbekistan

Climate change has been identified as an additional major risk for pollinators specifically in mountainous regions, depending only on wild pollinators on higher altitude. Pollinators are key species for agriculture, interaction within interdependent ecosystems and climate change adaptation of agro-ecosystems, because cross pollination enhances genetic diversity and thus the options for development of better adapted varieties. We suggest *Farming with Alternative Pollinators* (FAP) as an integrated agro-ecological-socio-economic approach and a self-sustaining win-win-strategy for farmers, agro-ecosystems and climate change adaptation. FAP is based on TEEB and uses the potential of wild pollinators for enhancement of crop production to make farmers local champions for their protection. Rapid loss of small glaciers will cause a cascade of disruptions, losses of plant biodiversity and induce alpine farmers to shift from irrigated wheat and potato to crops requiring less water (like fruits, vegetables, oilseeds, topinambur, various pulses) – but pollinators. Without wild pollinators mountainous regions cannot adapt to climate change.

References

Christmann, S. and A. Aw-Hassan (2012): Farming with alternative pollinators (FAP) - An overlooked win-win-strategy for climate change adaptation; AGEE 161, 161-164.

Tylianakis, J.M. (2013): The Global Plight of Pollinators. Science 29 March 2013: 1532-1533.Published online 28 February 2013 [DOI:10.1126/science.1235464]: Wild pollinators are in decline, and managed honeybees cannot compensate for their loss.

Garibaldi, L.A. et al. (2013): Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance. Science 29 March 2013: Vol. 339 no. 6127 pp. 1608-1611, DOI: 10.1126/science.1230200.

Gallai, N.; Salles, J.-M.; Settele, J. and B.E. Vaissière (2008): Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics* 68 (3): 810-821. doi:10.1016/j.ecolecon.2008.06.014

Contact

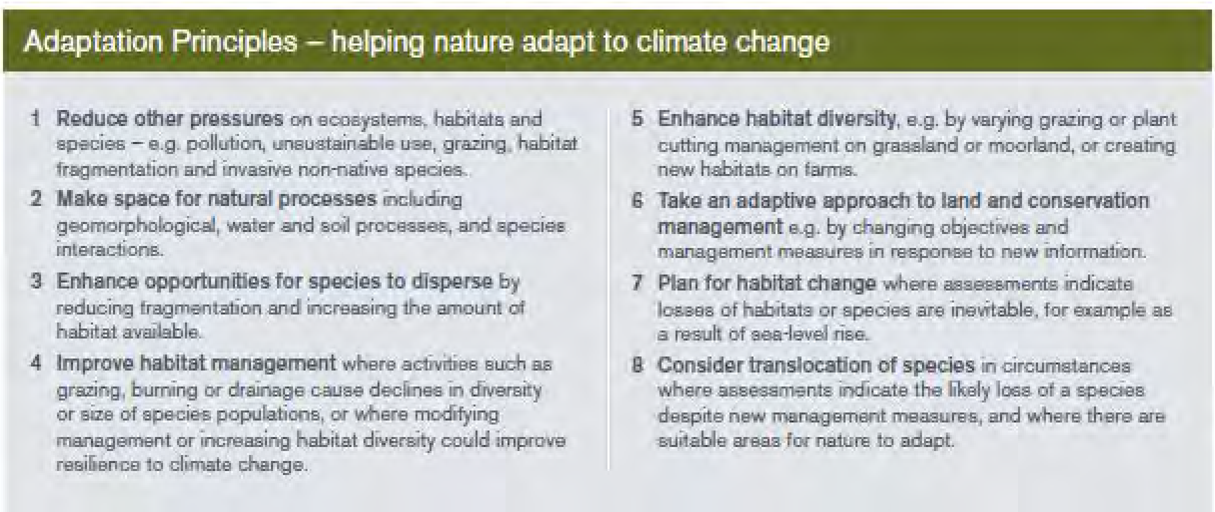
Dr. Stefanie Christmann
ICARDA
P.O. Box 4564
Tashkent 100 000
Uzbekistan
s.christmann@cgiar.org
www.icarda.org

4.6 Interactive Session II: Rivers, lakes and riparian ecosystems

Helping nature adapt to climate change in Scotland: showing how it can be done

CHRISTINA BELL
Scottish Natural Heritage, UK

In order to help nature adapt to climate change Scottish Natural Heritage (SNH) has outlined some adaptation principles to help land managers take an ecosystem approach to managing change (Figure 1). Addressing issues of uncertainty, resilience and accommodating change, decision makers are encouraged to use these as a framework to inform adaptation actions on land and in water.



Adaptation Principles – helping nature adapt to climate change

1. **Reduce other pressures** on ecosystems, habitats and species – e.g. pollution, unsustainable use, grazing, habitat fragmentation and invasive non-native species.
2. **Make space for natural processes** including geomorphological, water and soil processes, and species interactions.
3. **Enhance opportunities for species to disperse** by reducing fragmentation and increasing the amount of habitat available.
4. **Improve habitat management** where activities such as grazing, burning or drainage cause declines in diversity or size of species populations, or where modifying management or increasing habitat diversity could improve resilience to climate change.
5. **Enhance habitat diversity**, e.g. by varying grazing or plant cutting management on grassland or moorland, or creating new habitats on farms.
6. **Take an adaptive approach to land and conservation management** e.g. by changing objectives and management measures in response to new information.
7. **Plan for habitat change** where assessments indicate losses of habitats or species are inevitable, for example as a result of sea-level rise.
8. **Consider translocation of species** in circumstances where assessments indicate the likely loss of a species despite new management measures, and where there are suitable areas for nature to adapt.

Figure 1: SNH Adaptation Principles. Climate Change and Nature in Scotland (2012), p 17

Reducing pressures on habitats and species, making space for natural processes, and planning for change are frequently cited approaches for increasing ecosystem resilience to climate change. In practice, there are few on-the-ground demonstrations of good land management practice in pursuit of this. The benefits of demonstrating adaptation have recently been highlighted as follows:

- Real-time demonstration of techniques and measures at specific locations creates a body of evidence about what works and helps to normalise adaptation actions.
- Demonstration partnerships explore novel ways of working together to drive forward adaptation planning and action.
- Offer lessons that wider stakeholders can apply to their own organisational approach to adaptation. (Moffat et al. 2013)

To help catalyse adaptation planning and action in the wider land management sector, Scottish Natural Heritage is developing a series of case studies to demonstrate the adaptation principles (Figure 1). Some examples from the freshwater environment are shown in Figure 2.

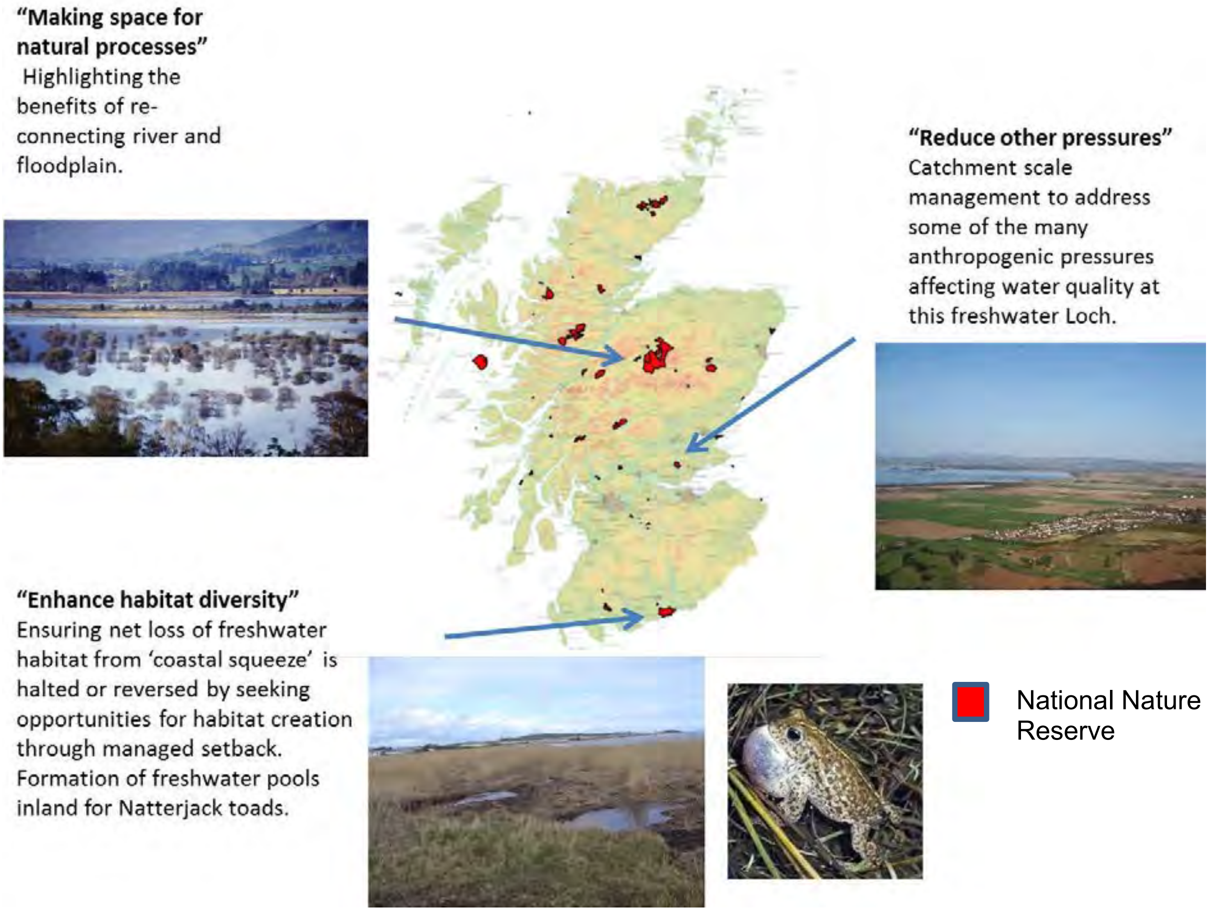


Figure 2: Adaptation Principles case studies under development (freshwater sites)

With a broad geographical spread, a wide range of habitat types (coastal, montane, woodland and freshwater) and management under SNH (or partners) control, the selected demonstration sites are drawn from across Scotland's National Nature Reserve (NNR) network. In addition to the benefits of demonstrating adaptation listed above, there will be opportunities to review the usefulness of the adaptation principles and stimulate discussions that will help to refine them further.

- Will the action significantly reduce the level of risk that climate change poses for nature?
- Will the action allow valued habitats or species to expand or increase?
- How important are the wider public benefits arising from the action? (Recognising the value people place on ecosystem services, such as carbon storage or flood alleviation).
- What are the costs associated with adaptation action?
- What are the chances of success?

With most NNRs accessible to the public and many management plans in the public domain, there is scope for interested parties to attend workshops focused on climate change adaptation in specific habitats. Facilitating opportunities to share experiences of land management re-affirms the value of our National Nature Reserves in helping drive the paradigm shift in thinking that climate change adaptation requires.

References

Scottish Natural Heritage (2012): Climate Change and Nature in Scotland. Available online: http://www.snh.org.uk/pdfs/publications/corporate/Climatechangenaturescotland.pdf

Moffat, A.; Nicoll, B.; Beckmann, K. and Roaf, S. (2013): Demonstrating adaptation – lessons learned so far in the forestry sector. Briefing note. Scotland's Centre of Expertise Connecting Climate Change Research and Policy (ClimateXChange).

Contact

Christina Bell
Climate Change Policy and Advice Officer
Scottish Natural Heritage
The Governors House
The Parade
Fort William
Inverness-shire
PH33 6BA
Tel. (+44) 1397 704716
christina.bell@snh.gov.uk

Riparian Ecosystems and Climate Change: the Value of Floodplains along the River Elbe

Alexandra Dehnhardt
Technische Universität Berlin, Environmental and Land Economics, Germany

Riparian ecosystems are considered as highly-productive sites with a high ecological value. They provide an abundant range of ecosystem services, which contribute to human well-being and directly benefit society (cf. Turner et al. 2008): they support high levels of biodiversity, they provide recreational opportunities, contribute to the regulation of nutrient and greenhouse gas fluxes, and reduce flood risk by providing inundation area. These multiple services and benefits are only provided by intact, natural floodplains, which functionality is maintained in the long-term. Due to manifold rivalling uses and flood protection measures (dyke building) that reduce the connectivity between river and floodplains, the extent of functional floodplains, however, has been dramatically reduced in the past: only 30% of the original floodplains in Germany are still maintained in a near-natural condition, while 70% of the retention area is lost, with consequences not only for biological diversity but also for local and regional flood protection (Brunotte et al. 2009).

Climate change will have a significant effect on local and regional hydrological regimes, which in turn will affect the biological diversity and the functionality in the riparian ecosystems that are particularly vulnerable to changing water conditions. Natural riparian ecosystems have a relatively high adaptive capacity, thus, the restoration of floodplains contributes to a higher resilience of the ecosystem itself to the impacts of climate change (cf. Capon et al. 2013). But furthermore, riparian ecosystem services are likely to become more important for humans under a changing climate twofold: firstly, restoration contributes to a reduction of greenhouse gas emissions and increased carbon storage in the floodplains soils (which refers to the climate change mitigation), and secondly, the enlargement of the retention area becomes more important for reducing flood risk considering the expected increase of flooding events under changing climate (which refers to the climate change adaptation).

These different services provided by riparian ecosystems are often not taken into account in decision-making. Thus, the ecosystem framework is increasingly used to explain and demonstrate the role of natural sites and ecosystems in supporting and improving human well-being. Furthermore, taking an economic perspective on ecosystem services might help to demonstrate its economic value for meeting societal needs and provides the basis for its integration into administrative and political decision-making by making costs and benefit of management options more comparable. Two recent studies in Germany apply the ecosystem service approach to explore the benefits of multiple floodplain functions and estimate the economic effects of floodplain restoration.

Scholz et al. (2012) quantify and assess floodplains functions and services for large rivers in Germany. The results demonstrate the societal benefits of natural floodplains: for example, they contribute considerably to an improvement of the water quality and thus protect the North Sea and Baltic Sea from further eutrophication due to the retention of up to 42,000 tons of nitrogen and 1,000 tons of phosphorus. Fens and floodplain forests along the rivers have a high potential for reducing greenhouse gas emissions. Furthermore, a qualitative assessment of the flood retention capacity of the present floodplains has been applied that estimates a limited retention in the case of flood events of 70%.

Grossmann et al. (2010) assess strategic land use choices from an integrated floodplain management perspective. Particular attention is given to estimate the monetary benefits from flood risk reduction, nutrient retention and wetland habitat conservation. Two types of measures have been regarded in an extended cost-benefit analytical framework: the relocation of dykes and controlled flood polders. The results for different floodplain management programs show that – considering the multifunctional services – natural flood protection measures are justified from an economic perspective, i.e. the benefits of restoring floodplains outweigh the costs. This supports a nature conservationist's strategy for a large scale floodplain restoration ('room for the river') as it demonstrates the multiple benefits of an integrated flood risk management perspective. However, to improve the integration of such ecosystem services in (climate change adaptation) policy-making, still more attention will need to be devoted to develop readily available methods for the quantification of effects as well as for benefit estimates.

References

Brunotte et al. (2009): Flussauen in Deutschland – Erfassung und Bewertung des Auenzustandes. Naturschutz und Biologische Vielfalt 87, Bundesamt für Naturschutz (BfN), Bonn.

Capon et al. (2013): Riparian Ecosystems in the 21st Century: Hotspots for Climate Change Adaptation? Ecosystems (16): 359-381

Grossmann et al. (2010): Ökonomische Bewertung naturverträglicher Hochwasservorsorge an der Elbe, Naturschutz und Biologische Vielfalt, Heft 89, Bundesamt für Naturschutz (BfN), Bonn.

Scholz et al. (2012): Ökosystemfunktionen in Flussauen. Analyse und Bewertung von Hochwasserretention, Nährstoffrückhalt, Treibhausgas-Senken-/Quellenfunktion und Habitatfunktion. Naturschutz und Biologische Vielfalt 124, Bundesamt für Naturschutz (BfN), Bonn.

Turner, K.; Georgiou, S.; Fisher, B. (2008): Valuing ecosystem services. The case of multifunctional wetlands. Earthscan: London.

Contact

Alexandra Dehnhardt
TU Berlin, Institute for Landscape Architecture and Environmental Planning,
Chair in Environmental and Land Economics
Straße des 17. Juni
Berlin, 10623
Germany
alexandra.dehnhardt@tu-berlin.de
www.landschaftsoekonomie.de

Potential climate change impacts on the habitat availability of floodplain vegetation - a case study from the Rhine River

Eva Mosner, Maria Carambia, Enno Nilson, Peter Horchler
German Federal Institute of Hydrology, Germany

River floodplains belong to the most diverse ecosystems in Europe due to their large spatial and temporal heterogeneity providing different niches for a great variety of species. Their high conservation value manifests in the EU Habitats Directive (92/43/EEC) with many riparian habitat types listed in Annex I. Moreover, the EU Water Framework Directive emphasises the important role of riparian areas for the functioning of the river ecosystem. Nonetheless, they are also highly endangered since rivers and adjacent floodplains were and are subject to human impacts such as river training, river regulation, and land use change. During the last centuries this has led to an enormous loss of floodplain area as well as to a transformation of remnant sites (Koenzen et al. 2009). In addition to these present threats, climate change is expected to menace the diversity and function of floodplains in the future (Palmer et al. 2009). The small scale distribution of species within the floodplain is strongly related to the hydrologic conditions. Hence, habitat availability could be altered due to changes in run-off patterns in the course of climate change. To effectively manage the conservation and restoration of floodplains, knowledge about the potential effects of climate change induced habitat changes is essential.

The aim of the subproject 5.06 – Impact of climate change on floodplain vegetation – in the framework of the KLIWAS programme ("Impacts of climate change on waterways and navigation – Searching for options of adaptation") was to assess potential changes in habitat availability of characteristic floodplain plant species in relation to possible hydrologic changes of the Rhine River. Therefore habitat distribution models (i.e. generalised linear models) were computed based on species distribution data as well as information about environmental conditions (e.g. water levels, water level fluctuations, land use) from the Upper and Lower Rhine River. As discharge change scenarios, five different projections from the KLIWAS multi model ensemble were selected which represented the potential range of future states regarding discharge and discharge variability. These model chains project the A1B SRES scenario of the IPCC AR4 using different combinations of global climate models, regional climate models, a hydrological model, and a hydraulic model. Changes were analysed with respect to the near (2021 - 2050) and the far future (2071 - 2100).

Results for the hydrologic changes indicated an increase of discharge when considered the whole year in contrast to a decrease during the vegetation period, at least for the far future. Discharge variability, on the contrary, was projected to increase up to 40% compared to the reference period. Especially the latter is crucial as habitat distribution models revealed an interaction of the two hydrologic variables, water level and water level fluctuations, in relation to species occurrences. For instance, *Fraxinus excelsior*, a characteristic species of riparian mixed forests, was found to occur on fairly high elevated sites along stretches with low water level fluctuations. With increasing fluctuations a habitat shift to lower elevated sites could be observed.

Evaluation of habitat changes displayed large variability in relation to the different species within vegetation types, between vegetation types, for different river stretches, the different projections, and the two future periods. While some species showed trends for net losses for river stretches and future periods others displayed net gains. Given the large variability between the five discharge projections, the respective habitat area projections were intersected to obtain a robust statement on the minimum amount of suitable habitat projected by all five ensemble members. Although the majority of projected habitats by the different ensemble members overlapped, differences between the species and the river stretches remained large. Generally, the availability of habitats was lower for the far future in comparison to the near future.

One of the biggest challenges concerning climate change and river floodplains is this large uncertainty about future hydrologic conditions and resulting habitat availability. Hence, to cover the range of possible outcomes one adaptation measure could be to increase spatial heterogeneity in the floodplain to provide habitat for all the different species under a variety of different environmental conditions.

Further information: www.kliwas.de

References

Koenzen, U. et al. (2009): Auenzustandbericht - Flussauen in Deutschland. pp 35, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Deutschland.

Palmer, M. A. et al. (2009): Climate Change and River Ecosystems: Protection and Adaptation Options. Environmental Management 44(6), p 1053-1068.

Contact

Eva Mosner
Dept. U2 Ecological Interactions, German Federal Institute of Hydrology
Am Mainzer Tor 1
56068 Koblenz
Germany
Mosner@bafg.de
www.bafg.de

4.7 Interactive Session III: Coastal & marine ecosystems

Green Infrastructure: A tool for reducing Europe's vulnerability to climate change

McKenna Davis, Sandra Naumann, Timo Kaphengst, Mav Pieterse, Matt Rayment and Elta Smith
Ecologic Institute, GHK Consulting

Green Infrastructure (GI) can be a valuable tool for reducing Europe's vulnerability to climate change by aiding adaptation and, to a lesser extent, mitigation efforts. By maintaining healthy ecosystems, reconnecting fragmented natural areas and restoring damaged habitats, GI offers a 'win-win' approach to combating climate change, as it has the potential to deliver multiple other benefits in parallel. This capacity is recognised by the recently published EU Green Infrastructure Strategy (2013), which strives to promote the deployment of GI in urban and rural areas across Europe.

Our research aimed to solidify the understanding of this concept by conducting a comprehensive overview of the design, implementation and cost efficiency of GI projects and initiatives in the EU to produce recommendations for policy action. Six in-depth case studies served to highlight the potential of GI to address conservation, environmental, social and economic objectives. One case study – the Väinameri project in Estonia – functions as a best practice example highlighting how GI elements can serve as economically viable and sustainable tools for increasing ecosystem resilience and therewith the ability to cope with expected climate change impacts, while also providing numerous additional benefits to the local populations.

The Väinameri Project was originally designed as one of six pilot projects to develop and implement Integrated Coastal Zone Management plans for the sustainable development of lagoons and wetlands in order to protect the ecology of the Baltic Sea and aid in adaptation efforts. The project sites are located in Estonia around the Väinameri Sea, a semi-enclosed area that covers approximately 2,000 km^2 and is connected by five straits to the Baltic Sea. These areas contain high levels of terrestrial and marine biodiversity and are threatened by flooding, storm surges and the loss of coastal ecosystems.

The Väinameri Project was thus developed to increase local employment opportunities, in particular for the farmers and individuals interested in developing ecotourism and handicrafts enterprises. These objectives were to be reached via the restoration and conservation of semi-natural coastal areas which were intensively farmed and then largely abandoned following the collapse of the Soviet state farm system in the early 1990s. Activities included the extensive grazing and mowing of naturally unfertilized grasslands to maintain the area's natural values, moderate clearing activities and sustainable resource extraction for handicraft production, alongside ecotourism, ecological education and awareness-building efforts.

By improving the resilience and functioning of the coastal habitats, the project improved adaptive capacity to foreseen climate change effects in two ways. First, the regional and international networks which were established provide an invaluable resource for increasing capacities and access to knowledge resources, thereby assisting current and future efforts to cope with extreme events or other climate induced changes. Second, the improvements in resilience of the targeted habitats and ecological systems ensure their continued functionality as flood defence mechanisms and thereby further reduce the area's vulnerability to climate change impacts. The project also provided additional benefits for the local population, including improved fishing and hunting opportunities, bird watching, and indirect economic effects to a range of local businesses through increased (eco)tourism.

Based on the results of this research project, a set of recommendations for policy actions in the EU as well as on national and local/regional levels has been prepared to strengthen the implementation of Green Infrastructure initiative throughout Europe. In general, policy makers at all spatial levels are asked to: (1) explore and use opportunities for cross-sectoral integration of GI in the relevant policies, (2) increase awareness of GI and create platforms for exchanges of knowledge and best practices, and (3) highlight the benefits received by various sectors and stakeholders. The implementation of these recommendations in support of the ambitions outlined in the EU's GI strategy can help to strengthen the resilience of ecosystems, reduce populations' vulnerability to climate change and contribute to improved socio-economic conditions.

Reference

Naumann, S.; Davis, M.; Kaphengst, T.; Pieterse, M. and M. Rayment (2011): Design, implementation and cost elements of Green Infrastructure projects. Final report to the European Commission, DG Environment, Contract no. 070307/2010/577182/ETU/F.1. Ecologic Institute and GHK Consulting

Contact

McKenna Davis
Ecologic Institute
Pfalzburger Strasse 43/44
10717 Berlin
Germany
+49 (30) 86880 166
mckenna.davis@ecologic.eu
www.ecologic.eu

Climate change limits elasmobranch recovery potential in the German Bight: A meta-population approach based on historical distribution data

HEINO O. FOCK, WOLFGANG NIKOLAUS PROBST, MATTHIAS SCHABER
Thünen-Institute of Sea Fisheries, Germany

Abundance trends and distribution patterns for 7 elasmobranch species in the German Bight (eastern central North Sea) are analysed from 1902 to 1932 and compared to survey trends 1991-2009. Abundances for thornback ray, common skate, smooth hound, tope and spiny dogfish declined and common skate became extirpated, while abundances for starry ray and lesser spotted dogfish increased. Based on biogeographic affiliation and life history traits, a meta-population approach is developed to indicate recovery potential of depleted populations.

Fishing pressure had the initial negative effect on elasmobranch stocks. For thornback ray, fishing mortality in the historical period and at present exceeded the maximum sustainable level generating a momentum for this species to become extirpated in the German Bight. Even lowest modeled values for fishing mortality exceeded FMSY. In the period after 1980, thornback ray had a high removal rate of 71%, compared to much lower values for starry ray, spiny dogfish and lesser-spotted dogfish of 38, 39, and 41%, resp. This is partly reflected in abundance trends, with abundances for starry ray and lesser-spotted dogfish increasing. However, despite the relatively low removal rate of spiny dogfish, with its low fecundity due to a 2-year interbirth interval spiny dogfish is much more vulnerable to fisheries (Fextinct=0.16) as compared to starry ray and lesser-spotted dogfish (Fextinct=0.33 and 0.49, resp.). Compared to its historic state, spiny dogfish has declined in the Northeast Atlantic and became extirpated in the German Bight, as did common skate and tope shark.

Life history and biogeographic affiliation indicate that Lusitanian species such as lesser-spotted dogfish and thornback ray have the potential to cope with climate change induced warming of the southern North Sea. Starry ray and spiny dogfish exhibit a widely boreal and temperate distribution pattern and penetrate well into subarctic waters. Thus, environmental warming in the southern North Sea likely prevents the recovery of spiny dogfish, even if fishing pressure could be reduced significantly. Species' vulnerability to fishing pressure is mainly compensated through shorter stage duration, i.e. earlier maturation rather than changes differential responses less change in fertility but rather change in mortality directly. Thus, starry ray with its small size at maturity and early age at maturity is in advantage over starry thornback ray. But given that fishing pressure could be reduced, fecundity in terms of litter size and Lusitanian affiliation offer the opportunity to recover for thornback ray. It is argued accordingly that the increase in starry ray is partly a competitive effect after thornback ray had declined significantly and thus could be reversed.

Recovery is dependent on suitable habitat. Habitat must be seen as both refuge and a function of available food. One particular area was identified for spiny dogfish and thornback ray, i.e. the Sylter outer reef (Fig. 1). This area was designated MPA for a Natura 2000 network for selection criteria related to seafloor habitats, seabirds and marine mammals and thus also proves its potential for elasmobranchs, given that appropriate measures are undertaken to reduce fishing pressure in the area. With high vulnerability of skates to beam trawling, a significant reduction of the dominant beam trawl fisheries could be effective in support of the recovery goal. This is further augmented by recalling the wide elasmobranch distribution ranges 1902-08 in light of 17% of the area being untrawled at that time. The significant effect of reduction of beam trawling was also shown for seafloor habitats (Fock et al. 2011).

The diet of *Raja clavata* comprises mainly shrimp and brachyuran decapods, and the proportion of fish prey is much smaller than for other skates. Spiny dogfish is a generalist feeder with a high proportion of low trophic level planktivorous fish prey such as clupeids or sandeels but relatively little crustacean diet. This highlights the importance of elasmobranchs for structuring food webs in the past, consuming large amounts of now abundant fisheries resources of sand eel, shrimp and clupeids. Accordingly, trophic cascades as consequences of elasmobranch removal with skate effects on invertebrate stocks and small shark effects on teleost fish are considered important. Further, interplay in resource competition between small sharks and marine mammals needs to be considered in this respect, since clupeids and sand eels are also among preferred food items for harbor porpoise.

For starry ray and lesser spotted dogfish an increase in donor population was the momentum for establishment of sub-populations in the German Bight even without supporting conservation measures for these two species. For thornback ray, conservation measures such as establishing stepping stones appear necessary. For spiny dogfish, common skate and starry ray climate change will be an irreversible pressure leading to an overall negative prospect on recovery in the German Bight.

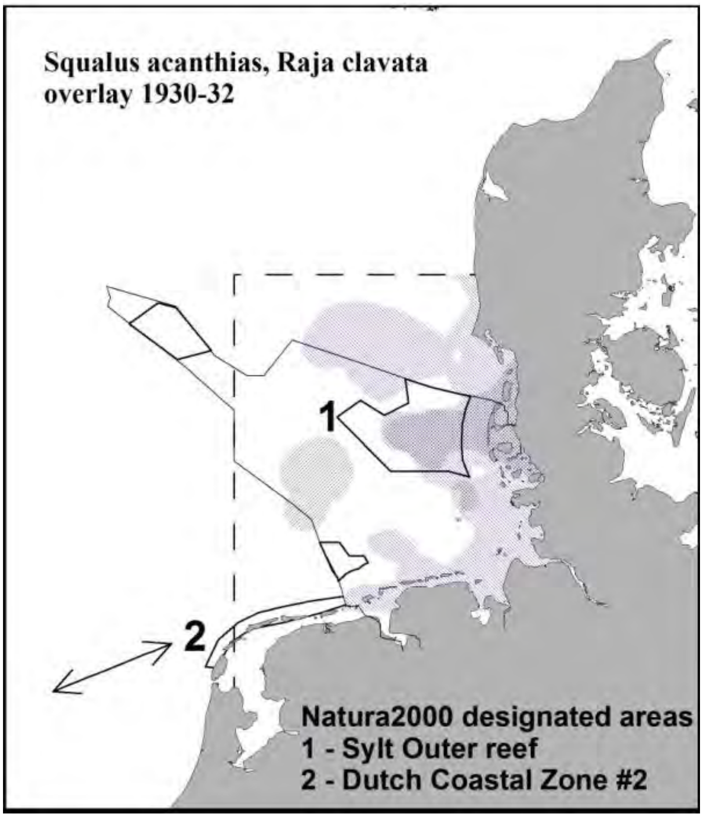


Figure 1: The importance of MPAs to serve as stepping stones and habitat for elasmobranch recovery. Sylt outer reef (1) is part of the German, whereas the Dutch coastal zone (2) belongs to the Dutch Natura 2000 network. Double headed arrow indicates patchways for thornback ray to re-enter the German Bight from seed patches off the English east coast. Grey shaded areas reflect historically inhabited areas by thornback ray and spiny dogfish. German EEZ indicated by thin line, broken lines indicate historic investigation area.

Reference

Fock, H.O.; Kloppmann, M.H.; Stelzenmüller, V. (2011): Linking marine fisheries to environmental objectives: a case study on seafloor integrity under European maritime policies. Environmental science & policy 14, 289-300.

Contact

Heino O. Fock
Thünen-Institute of Sea Fisheries
Palmaille 9
D-22767 Hamburg, Germany
+ 49 40 38905 169
Heino.fock@ti.bund.de

A strategy and an action plan for the Baltic Sea Region - A tool for reducing the region's vulnerability to climate change

Susanne Altvater, Katrin Kiefer, Franziska Stuke
Ecologic Institute; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany

Aims and added value of a BALTADAPT strategy and action plan

The EU Baltic Sea Region (BSR) Strategy recognised the problem of the countries concerned by climate change and called for a BSR-wide climate change adaptation strategy, which should help to create a coherent set of adaptation policies and actions from the transnational to the local level.

The BALTADAPT project (a Baltic 21 Lighthouse Project) therefore developed such a strategy focusing on the sea itself and its coastline. It aims to tackle the lack of transnational co-operation and joint planning in usage of Baltic Sea space. The corresponding action plan provides recommendations for *better knowledge transfer, cooperation, mainstreaming of adaptation measures and appropriate funding*.

The presentation gives an overview of these two strategic documents with a focus on recommended actions. In September 2013 the documents can be downloaded at www.baltadapt.eu. Key findings are integrated into the ClimateAdapt webpage (section: Baltic Sea Region).

The strategy and its action plan are developed through an intensive consultation process among relevant stakeholders as well as through the creation of a knowledge base with several reports and bulletins. However, the implementation and sustainability of the Strategy and its Action Plan (AP) depend on subsequent political endorsement, which exceeds the mandate of the BALTADAPT project.

Some of the specific added values related to BSR cooperation on identification and addressing knowledge gaps, and promoting science policy dialogue, with implications for all levels (from the local to the macro-regional and EU levels) are

- Research cooperation and transfer of best practices
- Promotion of innovations
- Science-policy dialogues on all levels
- Disaster risk reduction

The four main sectors marine biodiversity, coastal infrastructure, tourism and food supply, including fisheries and agriculture were identified in the BALTADAPT project. The selection of these four focus areas is based on the fact that climate adaptation within these areas can gain significantly from macro-regional cooperation. Impacts are expected in major parts of the region, which often are cross-boundary between states or between land and sea. These focus areas are also well corresponding to the objectives of the EUSBSR Action Plan.

However, a politically endorsed climate adaptation strategy is not foreseen to be limited to the four areas focused on in the BALTADAPT project, but to be complemented with new sectors in re-evaluations of the strategy.

Building and sharing knowledge about climate change adaption in the BSR

Despite a ground knowledge base, there are knowledge gaps on the full ecological, social and economic impacts of climate change (CC). Within the work of BALTADAPT a series of knowledge gaps that need additional research regarding climate change impacts have been identified for the coastal areas of the BSR.

The recommended actions support the objective to achieve a robust, policy-relevant, and research-based common knowledge on CC impacts, vulnerabilities and adaptation measures, including the handling of uncertainties and estimates of costs and benefits of adaptation action. Some recommendations are outlined in the following box:

Some recommended actions for building the knowledge base

In order to fill in the identified research needs, future research should focus on the following topics:

- More precise data, with special focus to develop spatial models and risk maps, new and/improved models on risk assessment and improvement of monitoring
- Studies on basic ecosystem processes and interactions under CC impact
- More focused impact assessments for sectors (e.g. health, infrastructure, tourism, agriculture, biodiversity and societal groups)
- Promotion of multi- and interdisciplinary studies on CC impacts, including scenario development and socio-economic assessments
- Economic assessments of costs and benefits of climate adaptation,
- Knowledge transfer and communication strategies on climate impacts, vulnerabilities and adaptation options to raise awareness
- Social sciences: the social context of adaptation responses, social barriers and incentives and integrated analysis of response strategies considering ecological and socio-economic limits and opportunities

Mainstreaming climate change adaptation in the BSR

The overriding aim of the BALTADAPT strategy is to ensure coherent adaptation throughout the macro-region BSR. To achieve this goal, also policies across all relevant sectors need to be reviewed and adjusted to CC adaptation concerns. Thereby possible CC impacts and adaptation needs within the model-region BSR are to be “mainstreamed”. Mainstreaming refers “to integrate adaptation objectives, strategies, policies, measures or operations such that they become part of the national and regional development policies, processes and budget at all levels and stages”.

Mainstreaming and cooperation are even more important, as the EUSBSR does not strive for the creation of new institutions or regulations. The BALTADAPT AP outlines the need for adaptation mainstreaming, provides an overview of the different approaches of the BSR countries to govern adaptation policy and develops first ideas for initiatives for a more consistent and comprehensive integration of CC adaptation considerations into policies at macro-regional level (see box).

Connecting the BSR for climate change adaptation

The Baltic Sea is a specific eco-region, leading to the assumption that the impacts of CC as well as the needs of adaptation will be specific too. It is important to connect all available knowledge and to ease its availability, dissemination and exchange. An added value will be achieved by cooperation with other macro regional groups like the Southern neighbouring states and non-EU countries like Russia, Norway and the Ukraine. The BALTADAPT Action Plan promotes the need for good cooperation between all levels on adaption, as well as on risk prevention and management including sharing 'best practices' that are proven to be economically, social and environmentally sustainable (see box).

Recommended actions for integrating adaptation in other policy processes:

Adaptation has to be further addressed as a topic in, for example, the Rural Development Policy, the national strategies for agro-biodiversity, the national strategies for the Sustainable Use and Protection of the Seas and the national strategies for Integrated Coastal Zone Management (ICZM).

Further cooperation of the BSR countries, the Council of the Baltic Sea states (CBSS) and other implementers of the macro-regional BALTADAPT Strategy with HELCOM to include CC into marine policy;

Include CC adaptation (stronger) in EU directives like the MSFD or WFD

Further support by the countries of the BSR for evaluating and completing the designation of a network of MPAs in the Baltic Sea according to the Natura 2000 network, the HELCOM Baltic Sea Protected Areas (BSPAs), the MSFD and the EU Biodiversity Strategy 2020.

Some recommended actions for transnational cooperation

- New institutional processes and better use of the existing institutions is needed
- The work and results of the different transnational and intergovernmental organisation active in adaptation would need to be better interlinked
- A transnational working group on climate change adaptation or different working groups/platforms discussing climate change adaptation in relation to different horizontal issues could be established
- Non-EU countries have to be involved in BSR projects, the focus should be on cooperation with Russia and cooperation with other countries in the Baltic Sea catchment area such as Norway, Belarus and Ukraine should be promoted whenever thematically relevant

Recommended actions for sectoral cooperation

- The support and facilitation of cross-sectoral cooperation on adaptation is needed

Recommended actions for participation

- Improved cooperation between the different ministries and competent authorities to harmonise legislation and policies regarding climate change and adaptation in order to make them consistent.
- An adaptation cooperation and coordination council could be established (where not present already) on the national levels as a consultative body
- Local stakeholder engagement has to be ensured in the development of adaptation strategies and measures

Recommended actions for research and science-business-policy cooperation

- Research cooperation between the BSR countries has to be supported
- Research needs have to be identified in cooperation with stakeholders, as well as decision support tools have to be developed with stakeholders to fulfill their needs

Adaptation actions for the four BALTADAPT focus sectors

Whereas the BALTADAPT Strategy identified the main CC impacts for the BSR the BALTADAPT AP identified the most important adaptation measures to address these impacts for the four focus sectors. In the following these precise adaptation measures are listed in the order of their ranking, based on a prioritization process. All actions are directly or indirectly related to several EU policies like the EU Biodiversity Strategy 2020, the MSFD, the CFP, and the CAP. The following box presents some recommendations for biodiversity:

Biodiversity

1. Include adaptation in the wording of European instruments like the BSAP, WFD, Habitats Directive and MSFD.
2. Implement agreed strategies to obtain "ecological" and "environmental" targets of the Baltic Sea and its coastal waters as obligated by the WFD, MSFD, BSAP and national action plans.
3. Reduce the loss of nutrients from point sources and diffuse sources such as, atmospheric input and farming, e.g. by a) re-establishment of wetlands and meandering rivers to enhance de-nitrification b) changes in agricultural practice (winter crops, restricted use of fertilizers and manure) c) highly effective sewage treatment d) buffer strips, filter systems in drained agricultural areas support (re-establishment of macrophytes, mussel beds)
4. Use spatial planning instruments, e.g. for the integration of CC impacts on coastal protection in regional planning and the regulation of buildings, identification of buffer zones/hazard zones, restrictions for development in protected zones in coastal areas, setback zones

Financing climate change adaptation in the BSR

Funding programmes constitute an essential regulatory instrument for the BSR member states and have a crucial influence on, for example, the investment and land use decisions taken by other actors.

On the EU level the "Common Strategic Framework" governs the EU Regional Development, Social, Rural Development and Fisheries Funds in order to ensure the achievement of the objectives of the EU 2020 strategy. One of the five core objectives of the EU 2020 strategy relates to CC. Under the Multi-Annual Financing Framework (MFF) it has been agreed that the climate related expenditure will represent at least 20% between the years 2014 – 2020. "Promoting climate change adaptation, risk prevention and management" is one of the eleven priorities of the Commission's proposal for a Common Strategic Framework which provides a common set of rules for the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD) and the future European Maritime and Fisheries Fund (EMFF).

To foster governance and implementation, the aim of the EUSBSR is to identify and recommend available transnational funding opportunities for CC adaptation. Furthermore it is intended to ensure common development of policies for funding of CC issues. The EUSBSR foresees the possibility of financial assistance by the Seed Money Facility which is operational as of early 2013. Herewith, the preparation phase of project applications contributing to the objectives of the EUSBSR can be supported.

Besides this, actions and projects might require financing on national, regional and local level including the private sector.

Contact

Susanne Altvater/Katrin Kiefer
Ecologic Institute/ Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Pfalzburger Str. 43-44/ Köthener Str. 2-3
Berlin, 10717
Germany
susanne.altvater@ecologic.eu
www.ecologic.eu

4.8 Interactive Session IV: Grassland & Urban ecosystems

Can agri-environment schemes deliver adaptation for the natural environment?

Simon Duffield, Trevor Mansfield and Mike Morecroft
Natural England

Over the last decade numerous papers have been published highlighting recommendations and actions to promote adaptation for the natural environment. Within these four clear themes can be identified: actions that aim to increase ecological resilience; the need to focus on particular areas that are either vulnerable or can act as likely climate change refugia; the need to plan for and accommodate change and the requirement for an adaptive management approach.

When it comes to delivering adaptation on the ground, one of the biggest levers are agri-environment schemes funded under Pillar 2 of the Common Agricultural Policy (CAP). To effectively address adaptation, it needs to be factored into the overarching design of agri-environment schemes and their spatial targeting, as well as the management measures which are promoted.

Using the Leckford Estate, Hampshire as a case study we highlight how current agri-environment delivery addresses these four themes.

The combination of a landscape scale scheme with simple options and a targeted scheme with more complex options, is able to deliver management that promotes the resilience of habitats and species through incentivizing management that: conserves and enhances existing areas of biodiversity, improves the coherence of ecological networks through the creation of more sites and improves connectivity through enhancing the permeability of the matrix between sites. The mechanism by which the scheme is targeted will enable action to be focused on areas particularly vulnerable to climate change, and climate change refugia, although the spatial data to enable this is still be developed.

The prescriptive nature of elements of the schemes limits the ability to plan for and accommodate change, however the outcome focused nature of the schemes, a built in break clause and the relative short duration of agreements (5-10years) means that they have the potential of take into account the impact of climate change. Current agri-environment schemes in England are less suited to promoting adaptive management. This is largely due to the need to provide an audit trail for compliance, combined with high penalties for failing to comply, which encourages a risk adverse approach rather than an approach that encourages learning through doing.
These findings are discussed in light of the current round of CAP reform.

Contact

Simon Duffield
Mail Hub Block B
Whittington Road
Worcester WR5 2LQ
United Kingdomv
Simon.duffield@naturalengland.org.uk

Climate change in Northeast Germany – a risk assessment for ecosystems in the scope of nature conservation planning

NADINE NUSKO, PHILIPP ARNDT, VERA LUTHARDT
Eberswalde University for Sustainable Development - Department of Landscape Management and Nature Conservation, Germany

Introduction

The federal state of Brandenburg in NE-Germany will be significantly affected by climate change. Projected changes in precipitation distribution, continuing increase of average daytime temperature and extended vegetation periods, will likely cause longer periods of drought and more frequent extreme weather events (Linke et al. 2010). The region is already characterized as relatively dry and the status of the landscape water budget is largely critical (Zebisch 2005, Holsten 2009).

The effects of climate change in combination with other stresses (e.g. pollution, landscape fragmentation) will lead to a much higher stress on biodiversity in the future. How fast changes will emerge is regionally different depending on the resilience, respectively the vulnerability of ecosystems and their compartments (IPCC 2007).

To enable nature conservation administration to take a proactive management under a changing climate, it is necessary to know which ecosystems are potentially affected and which structures exist to buffer or intensify possible disturbances.

Our working group is developing a method to assess the vulnerability of different ecosystem types under a changing climate. We develop and test the method by applying it to the biosphere reserve Schorfheide-Chorin, where the management and development plan is currently worked out.

Methods and Results

Site sensitivity

It is assumed that major problems for ecosystems in Brandenburg will be caused by a critical landscape water budget resulting in drought stress for the characteristic phytocenosis (Gerstengarbe 2003, Riek 2010). Therefore we focused our analysis on the localization of drought risk under a changing climate. We follow the concept of Parry (2007), who defined the vulnerability of a system as a result from the interaction of any change in exposure, particular sensitivity and specific adaptive capacity. In this context we need to figure out

- To what extend are different areas affected by climatic changes?
- Which ecosystems within these areas are particularly sensitive?
- Which structures exist to buffer or intensify possible disturbances?

The analysing approach is based on a spatial analysis of regional climate change projections and potentially effective system parameters.

First we analyse the hydrological soil conditions. Because of the different parameters which influence the water availability on these sites, we distinguish between hydromorphic soils (histosols, gleysols and stagnosols) and anhydromorphic soils and their associated soil texture classes (BGR 2007, LUGV 2007, MUGV 2009, LFB 2010). This allows us to derive information about hydrological soil properties such as storage capacity and capillary suction.

We combine this information with a regional climate change scenario for annual climatic water balance (based on STAR2 by PIK 2011) and past trends in groundwater changes (LUGV 2009) for histosols and gleysols (Fig.1).

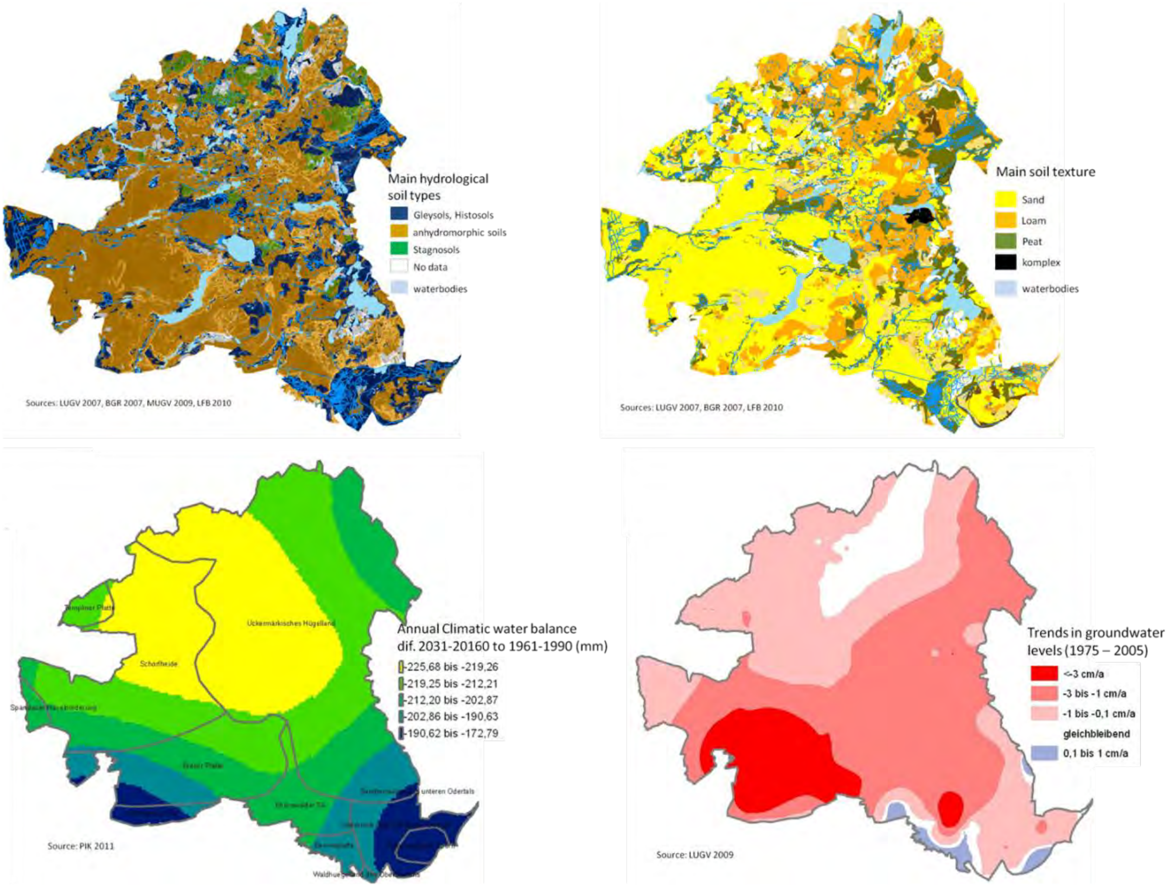


Figure 1: Input data for the *site sensitivity* assessment (main hydrological soil types, main soil texture and associated hydrological soil properties, projected annual climatic water balance and past trends in groundwater change) for the biosphere reserve Schorfheide-Chorin.

The assessment of all relevant indicators is carried out on a five-point scale from “very low” to “very high”. Thus, we assess the potential sensitivity of the different sites for drought and identify areas of greater risk (Fig. 2).

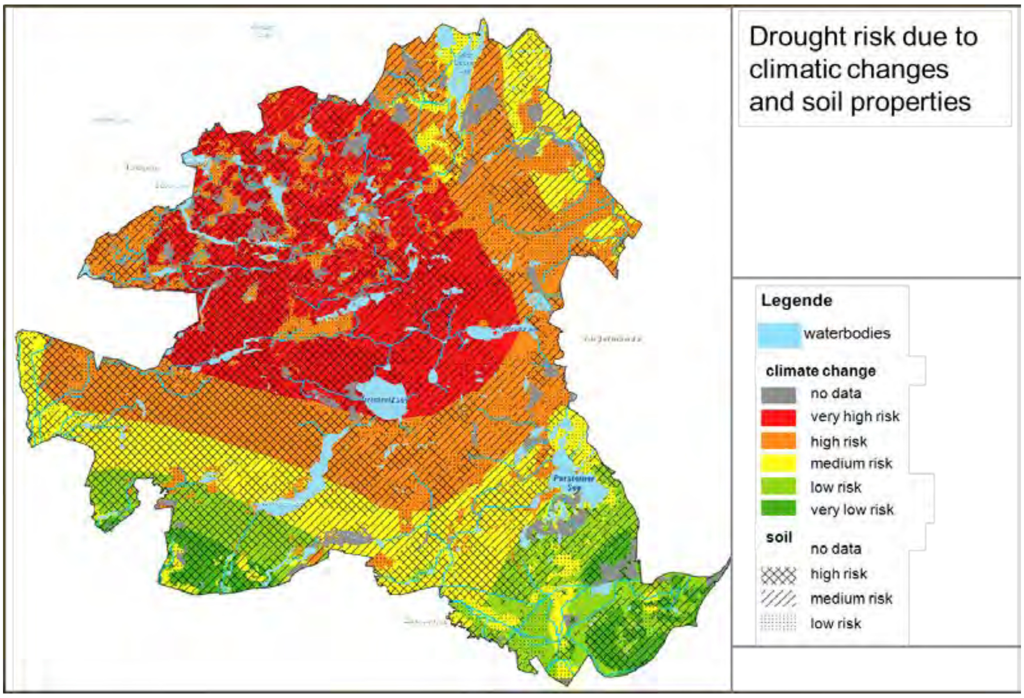


Figure 2: Visualisation of drought risk due to climatic changes and soil properties.

The results serve as basis for the risk assessment of the biotic components within these areas.

Biotope sensitivity

We focused our analysis on ecosystems with a high nature conservation value and a potentially high risk under a changing climate (Petermann 2007). Thus, we assess the sensitivity for mires and peatlands, grasslands and near-natural forests (Fig. 3).

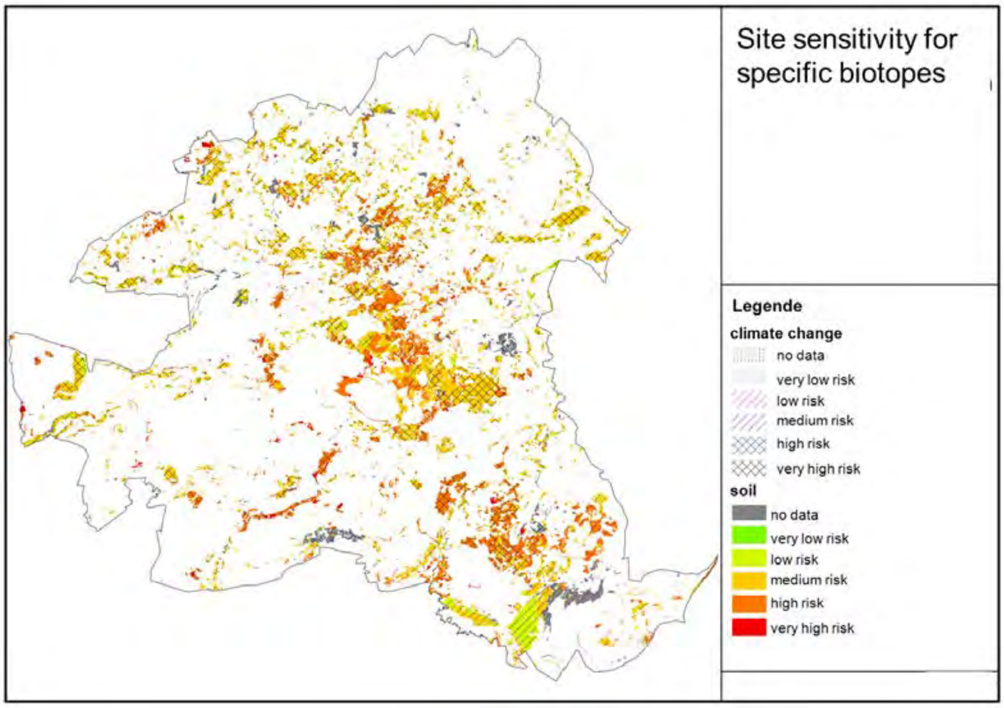


Figure 3: Visualization of drought risk due to climatic changes and soil properties for specific biotopes.

As we hypothesise that plant communities with a need of high and balanced water levels are most sensitive (like sphagnum-lawns) concerning a high risk of drought, we assess the sensitivity of the biotope type by the demand of its plant community to water levels and fluctuations. For this purpose we use the indicator value “moisture” (Ellenberg 1992) as well as literature and expert knowledge.

The combination of the *site sensitivity* and the *biotope sensitivity* shows us the impact or the potential vulnerability of a specific biotope on a specific site.

In order to assess the actual vulnerability of a system the adaptive capacity which is highly dependent on present local conditions must be considered (IPCC 2007). Utilisation, anthropogenic disturbances and present condition of the biotope are some elements which need to be taken into account.

References

Ad-hoc-Arbeitsgruppe Boden (2005): Bodenkundliche Kartieranleitung, 5. Aufl., Hannover: 438 S.

Bundesanstalt für Geowissenschaften und Rohstoffe (2007): Mittelmaßstäbige Landwirtschaftliche Standortkartierung (MMK)

Ellenberg, H. (1992): Zeigerwerte der Gefäßpflanzen Mitteleuropas (2. Aufl.). Scripta Geobotanica Vol. 18; Göttingen: 258 S.

Ellner, B. (2011): Analyse der Vulnerabilität von Wald-Biotoptypen gegenüber dem Klimawandel am Beispiel des Nationalparks Unteres Odertal. Master thesis, HNE Eberswalde

Gerstengarbe, F.-W.; Badeck, F.; Hattermann, F.; Krysanova, V.; Lahmer, W.; Lasch, P.; Stock, M.; Suckow, F.; Wechsung, F.; Werner, P.C. (2003): Studie zur klimatischen Entwicklung im Land Brandenburg bis 2055 und deren Auswirkungen auf den Wasserhaushalt, die Forst- und Landwirtschaft sowie die Ableitung erster Perspektiven. PIK Report NO. 83. Potsdam-Institut für Klimafolgenforschung; Potsdam: 77 S.

Holsten, A.; Vetter, T.; Vohland, K.; Krysanova, V. (2009): Impact of climate change on soil moisture dynamics in Brandenburg with a focus on nature conservation areas. Ecological Modelling 220: 2076-2087.

IPCC (2007): Climate change 2007: The physical science basis (Summary for policymakers). Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change; Cambridge University Press: 18 S.

Landesamt für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg (2009, Eds.): Umweltdaten aus Brandenburg: Bericht 2009; Potsdam: 126 S.

Landesamt für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg (2007): Niedermoorkarte des Landes Brandenburg

Landesamt für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg (2009): Biotopkartierung des Landes Brandenburg

Landesbetrieb Forst Brandenburg (2010): forstliche Standortdaten Land Brandenburg

Linke, C.; Grimmert, S.; Hartmann, I.; Reinhardt, K. (2010): Auswertung regionaler Klimamodelle für das Land Brandenburg – Darstellung klimatologischer Parameter mit Hilfe vier regionaler Klimamodelle (CLM, REMO10, WettReg, STAR2) für das 21. Jahrhundert. Fachbeiträge des Landesumweltamtes Brandenburg 113; Potsdam: 305 S.

Meier-Uhlherr, R.; Jünemann, M.F.; Luthardt, V.; Joshi, J. (2011): The vulnerability of mires in Brandenburg (Germany) to climate change – developing a vulnerability index. 41st Annual Meeting of the Ecological Society of Germany, Oldenburg

Ministerium für Umwelt, Gesundheit und Verbraucherschutz (MUGV) (2010): Gewässerdaten Mittlere Abflussspende für die Zeitreihe 1976 – 2005; Abimo 2.1.

Parry, M.L.; Canziani, O.F.; Palutikof, J.P.; van der Linden, P.J.; Hanson, C.E. (2007): Climate Change 2007: Impacts, Adaption and Vulnerability - Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press; Cambridge: 976 S.

Petermann, J.; Balzer, S.; Ellwanger, G.; Schröder, E.; Ssymank, A. (2007): Klimawandel - Herausforderung für das europaweite Schutzgebietssystem Natura 2000. In: Natura 2000 und Klimaänderungen. Tagungsband zur gleichnamigen Tagung, (Insel Vilm, 28.-31.08.2006). Naturschutz und Biologische Vielfalt 46. Bundesamt für Naturschutz (BfN); Bonn-Bad Godesberg: 127-148.

Riek, W. (2010): Regionale und standortsbedingte Unterschiede zu den Auswirkungen des Klimawandels. In: Wissenstransfer in die Praxis – Beiträge zum 5. Winterkolloqium am 25. Februar 2010 in Eberswalde. Eberswalder Forstliche Schriftenreihe 44: 38-48.

Schmidt, R.; Diemann, R. (1991, Eds.): Erläuterungen zur Mittelmaßstäbigen Landwirtschaftlichen Standortkartierung (MMK). Forschungszentrum für Bodenfruchtbarkeit Müncheberg: 78 S.

Schulze, G. (1996a): Anleitung für die forstliche Standorterkundung im nordostdeutschen Tiefland – (Standorterkundungsanleitung) SEA 95: Bd. A – Standortsform: 1-298.

Schulze, G. (1996b): Anleitung für die forstliche Standorterkundung im nordostdeutschen Tiefland – (Standorterkundungsanleitung) SEA 95: Bd. B – Praktisches Arbeitsverfahren: 1-252.

Schulze, G. (1998): Anleitung für die forstliche Standorterkundung im nordostdeutschen Tiefland – (Standorterkundungsanleitung) SEA 95: Bd. D – Bodenformen-Katalog. 3. Aufl.: 1-252 S.

Zebisch, M.; Grothmann, T.; Schröter, D.; Hasse, C.; Fritsch, U.; Cramer, W. (2005): Klimawandel in Deutschland - Vulnerabilität und Anpassungsstrategien klimasensitiver Systeme. Umweltbundesamt; Dessau: 203 S.

Contact

Nadine Nusko
Eberswalde University for Sustainable Development - Department of Landscape Management and Nature Conservation
D-16225 Eberswalde
Friedrich-Ebert-Straße 28
Nadine.Nusko@hnee.de

How can urban brownfields contribute to climate adaptation and human well-being in cities?

Juliane Mathey, Stefanie Rössler, Juliane Banse, Iris Lehmann
Leibniz Institute of Ecological Urban and Regional Development, Germany

Sustainable urban development has to tackle manifold challenges, such as stopping the loss of biodiversity and ensuring ecosystem services and therewith assuring the human well-being in cities. Urban green spaces are habitats for plants and animals and are the main places in urban areas, where ecosystem services are provided. They play a crucial role in adaptation to climate change by providing natural cooling within the urban heat island, increasing air humidity and air circulation (Gill et al. 2007). Additionally they may support storm water and flood management due to expected heavy precipitation. Against the background of the challenges mentioned above, for cities it becomes essential to have richly structured and multifunctional green space systems.

Often, brownfields are the only areas where new green spaces can be created in densely built up cities. Urban brownfields are interesting for urban green space systems, since they provide a brought spectrum of urban nature types due to their various succession stages of vegetation. They often bear a high biodiversity and belong to the most valuable areas for nature protection in cities. Furthermore the spontaneous vegetation is suitable for recreation, nature experience (Rebele and Dettmar 1996) and can contribute to buffer climate change related impacts in cities (Mathey et al. 2011).

The conservation of these spontaneous biotopes on the one hand, and the active greening of brownfields, on the other hand opens up potentials to provide the needed manifold ecological, social and aesthetic benefits. Thus, brownfields can play a crucial role in influencing the quality of life of urban population. For a successful implementation of new green brownfield developments the acceptance of local residents is important (Hofmann et al. 2012).

Based on findings on (1) the micro-climatic potentials of brownfields and (2) the perception and acceptance of such urban areas by residents (3) some planning recommendations are derived.

(1) The modelling of the temperature effects of different urban vegetation structure types in comparison to an asphalt covered reference site at a hot summer day showed differences by 0.1 to 2.4 K (air temperature at a height of 1.20 m, 2 p.m). In built-up areas the strongest cooling effects of 0.7 K can be expected in extensively greened residential areas. A wide range of potential cooling effects can be achieved in urban parks, ranging from up to 2.4 K in those with dense tree stocks to an average of 0.8 K in typical neighbourhood parks with a high proportion of lawns and less dense tree stocks. Young brownfields with ruderal pioneer vegetation can reach cooling effects of 1.4 K. Old brownfields with dense groves, highly growing herb layer and typical wood cooling can even have effects of 1.7 K (Mathey et al. 2011).

(2) The results of a resident survey show that urban brownfields are perceived ambivalently; although negative attitudes dominate, there is however, an opposing view which values brownfields in a clearly positive manner. The judgement depends on the type of brownfield, in particular the density and structure of the vegetation. Unmanaged brownfields with spontaneous wild vegetation are often not seen as being aesthetic and are poorly accepted by the population. Whilst sealed areas, which are almost free from vegetation, are only

accepted and used very little, the attractiveness of brownfields with natural succession increases with more vegetation, but then decreases with high, forest-like growth. Concerning wishes for future uses the majority of those questioned would like to have a planned and designed after-use, such as a laid-out public green space and parks as well as green spaces with trees (Banse and Mathey 2013).

(3) The conservation of spontaneous wild vegetation and the active re-greening of urban brownfields are seen as valid alternatives to new construction on urban wastelands. Green brownfields have the potential to buffer climate related impacts in cities. It is possible to raise a wide acceptance for the realisation of more unconventional concepts (brownfields with succession areas) by partial upgrading and by including residents in the planning process. Also new types of green spaces can be implemented to both raise awareness and ensure ecosystem services, as urban agriculture, urban forestry, gardens, alternative sport and leisure facilities, sites for events, places for nature discovery.

References

Banse, J.; Mathey, J. (2013): Wahrnehmung, Akzeptanz und Nutzung von Stadtbrachen. Ergebnisse einer Befragung in ausgewählten Stadtgebieten von Dresden (Perception, acceptance and use of urban brownfields. Results of a survey in selected quarters in Dresden). CONTUREC 5, forthcoming.

Gill, S. E.; Handley J. F.; Ennos, A. R.; Pauleit, S. (2007): Adapting cities for climate change: The role of the green infrastructure. Built Environment 33/1, 115-133.

Hofmann, M.; Westermann, J. R.; Kowarik, I.; van der Meer, E. (2012): Perception of parks and urban derelict land by landscape planners and residents. Urban Forestry & Urban Greening 11, 303-312.

Mathey, J.; Rößler, S.; Lehmann, I.; Bräuer, A.; Goldberg, V.; Kurbjuhn, C.; Westbeld, A (2011): Noch wärmer, noch trockener? Stadtnatur und Freiraumstrukturen im Klimawandel. (Yet warmer, yet drier? Urban nature and open space structures in the context of climate change). In: Bundesamt für Naturschutz (BfN, Hrsg.): Naturschutz und Biologische Vielfalt Heft 111, Bonn-Bad Godesberg, 220 S.

Rebele, F.; Dettmar, J. (1996): Industriebrachen. Ökologie und Management (Industrial brownfields. Ecology and management). Eugen Ulmer Stuttgart.

Contact

Dr. Juliane Mathey
Leibniz Institute of Ecological Urban and Regional Development (IOER)
Weberplatz 1
01217 Dresden
Germany
j.mathey@ioer.de
www.ioer.de

Adaptation to change. How to manage urban ecosystems in a changing climate

Stefan Heiland, Christian Wilke
Technische Universität Berlin, Department of Landscape Planning and Development, Germany

Urban areas are characterised by a wide variety of ecosystems. Most of them have to be intensively managed in order to fulfill the functions necessary for cities and their inhabitants and for serving human well-being and quality of life. Green spaces play a crucial role for recreational use, climate regulation, air quality, provision of drinking water etc. In this context the existing biodiversity is usually not an end in itself, but a side effect of the satisfaction of human needs and interests. It evolves and changes with changing societal requirements – but also contributes to their fulfillment. Therefore fostering urban biodiversity should be linked to or justified by fostering other purposes – as a rule, exceptions included. This doesn't have to be as difficult as one might possibly assume, because 'nature' and 'green' are strongly appreciated and highly estimated by people. For example in Germany one of the most important factors that influence people's perception of their vicinity is the proximity to 'nature' and public green spaces. And: The economic value of an area increases with the quantity and quality of adjacent green spaces or even road-side trees. Above that urban green spaces have a wide range of positive impacts on human health as various studies show.

Undoubtedly valuable 'natural areas' with a high richness of (threatened) species should be protected and adapted to climate change because of their biodiversity, but in most parts of an urban area other reasons are of higher importance for our societies. One of the central points why cities have to adapt to climate change is that human health might be threatened by e.g. higher temperatures during day and night. Different examples (e.g. Berlin, Leipzig) show that it is necessary to identify the most affected or vulnerable parts of the city before taking action. Appropriate criteria for such an analysis are dependent on the data available. Examples are thermal pollution or number of days with maximum temperatures above 30°C (exposure); share of sensitive population groups, population density, sealing, existence of green spaces or road-side trees (sensitivity); recreational zones outside the cities to be reached within a certain time (adaptive capacity). The resulting measures to minimise urban heat effects often include the protection, enhancement or expansion of green spaces which might serve for the protection of existing or creation of new habitats – even if that does not necessarily lead to an improvement of habitats of threatened species with special habitat requirements. Many studies point out that urban green spaces are one of the most important means to adapt to climate change in urban areas – but we have to be aware that at the same time they are affected by a changing climate themselves. Therefore, their management and structures (plant species and design) have to be adapted to changing temperature and water conditions as well.

Contact

Prof. Dr. Stefan Heiland
Technische Universität Berlin,
Sekr. EB 5, Fachgebiet Landschaftsplanung und Landschaftsentwicklung
Straße des 17. Juni 145
10623 Berlin
Germany
stefan.heiland@tu-berlin.de
www.landschaft.tu-berlin.de

4.9 Interactive Session V: Forest & woodland ecosystems

Monitoring of potential climate-induced impacts on woodland habitats with earth observation methods

MICHAEL FÖRSTER, TOBIAS SCHMIDT, BIRGIT KLEINSCHMIT
Geoinformation in Environmental Planning Lab, Technische Universität Berlin, Germany

Remote sensing has been established as a valuable source of supporting field mapping and monitoring of vegetation. However, in terms of monitoring climate-induced impacts on habitats the time-span of data acquisition is often not long enough. Therefore, within the project Habit-Change (Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas – implemented within the INTERREG IV B CENTRAL EUROPE program) we introduce different methods for monitoring forest areas, which show the possibilities of providing indicators of potential climate change impacts.

For the Vessertal, a forested area in Germany, the immigration of beech in a spruce dominated region – a potential effect of climate change – was investigated with multi-temporal satellite images (Landsat and RapidEye) between the 1980s and 2011. The Biosphere Reserve Vessertal is situated in the middle of Germany in the Thuringian Forest. With 88% forest cover, the biosphere reserve can be characterised as an almost completely forested area, containing approximately 70% share of spruce. The second main tree type is beech, occurring in two habitat types, namely *Luzulo-Fagetum* beech forests and *Asperulo-Fagetum* beech forests.

In a first step, we aimed at showing the changes in the share of spruce and beech between the mid-80s and today, which are mainly due to forest conversion in the region, but might be related to climate change, too. Therefore, we acquired eight Landsat Scenes between 1986 and 2010. The single dates were pre-processed and subsequently classified with an ISODATA clustering. The outcomes of these clusters were intersected with the forest segments from the silvicultural inventory map of the region to compute the number of pixels per class. Afterwards, the percentages were aggregated to tree species composition classes. Figure 1 shows the results of the analysis. It is visible that after the reunification, the share of open landscape (e.g. grassland, agriculture) was decreasing, while the general forest amount was increasing. From 2003, a slight decrease in spruce is visible, while beech is increasing. This can be related to the forest conversion in the region but might as well support the general trend of reestablishment of the more site-adapted beech. The slight increase of wood-less area in 2009 might be a result of the hurricane Kyrill in the year 2007.

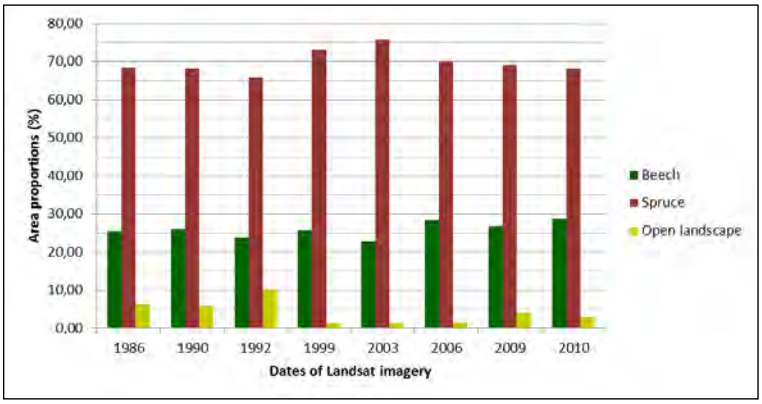


Figure 1: Temporal development of tree species in the Vessertal region between 1986 and 2010.

To show the potential of a possible indicator on changes in habitat quality we acquired a time-series of seven RapidEye images in the vegetation period of 2011. RapidEye is a constellation of five satellites and provides high resolution (6.5 m) and temporal (revisiting time of approximately 5.5 days) imagery (Schuster et al. 2012). We used this information to distinguish the percentage of natural forest types, which is one of the factors to determine the conservation status of a forest habitat within the Natura 2000 habitat types within Germany (Förster et al. 2008). A multi-temporal supervised classification with the Support Vector Machine (SVM) algorithm was performed to generate a thematic tree species map. The results of this study shows, that the conservation status of different Natura 2000 habitat types can be distinguished. The *Luzulo-Fagetum* beech forests have a high percentage of areas assigned to the conservations status unfavourable-bad (55.2%) while *Asperulo-Fagetum* beech forests have a higher amount of areas detected as favourable (57.7%). This corresponds with the field based finding in the study site (Frischbier et al. accepted).

This case study shows the strengths and limitations of identifying indicators of relevance to climate change. Although the provided indicator can supply information about the development of habitat occurrence and conservation status, the results overlap with the general anthropogenic induced forest management in the area.

References

Förster, M.; Frick, A.; Walentowski, H. & Kleinschmit, B. (2008): Approaches to utilising Quickbird-Data for the Monitoring of NATURA 2000 habitats. Community Ecology, 9, 155-168

Frischbier, N.; Profft, I. & Hagemann, U. (accepted): Potential impacts of climate change on forests and climate-induced habitat shifts in the Biosphere Reserve Vessertal-Thuringian Forest in Germany. In: Rannow, S. and Neubert, M. (eds.): Managing protected areas in Central and Eastern Europe under climate change. Series: Advances in Global Change Research. Springer. pages pending

Schuster, C.; Förster, M. & Kleinschmit, B. (2012): Testing the red edge channel for improving land-use classifications based on high-resolution multi-spectral satellite data. International Journal of Remote Sensing, 33, 5583–5599

Contact

Michael Förster
Technische Universität Berlin
Str. d. 17. Juni 145 (Office: EB5)
10623 Berlin
Germany
michael.foerster@tu-berlin.de
http://www.geoinformation.tu-berlin.de/

Social learning processes developing local climate change scenarios as a precondition for sustainable reforestation

Stefanie Christmann, Aden Aw-Hassan, Toshpulat Rajabov, Himoil Khalilov
Environmental Governance, ICARDA, SEPRP, ICARDA-Headquarter; Samarkand State University, Uzbek Research Institute of Karakul Sheep Breeding and Desert Ecology, Uzbekistan

A social learning process developing local climate change scenarios and the participatory development of a local environmental governance scheme with landscape approach overcame apathy and resignation to out-migration and abandonment of impoverished villages within the next decades in a region most prone to climate change induced deterioration of living conditions. Years after literally the last tree was cut the social learning process developed the common purpose to collectively restore foothill vegetation consisting of drought tolerant forage shrubs and medicinal trees and shrubs to safeguard livelihoods from devastating mudflows and for creation of new income options by tourism and purchase of medicinal fruits. Based on this common purpose they developed a sustainable governance scheme with equal tasks and benefit for each household, enforcement and a new system to manage livestock currently fueling desertification. The integrated approach using scenarios and collective governance approaches has high value specifically for countries neighboring the Mediterranean.

References

Schusler, T.M.; Decker, D.J. and M.J. Pfeffer (2003): Social learning for collaborative natural resource management. *Society and Natural Resources* 15(4), 309-326.

Johnson, K.A.; Dana, G.; Jordan, N.R.; Draeger, K.J.; Kapuscinski, A.; Schmitt Olabisi, L.K. and P.B. Reich (2012): Using Participatory Scenarios to Stimulate Social Learning for Collaborative Sustainable Development. *Ecology and Society* 17(2):9.

Liu, J.; Dietz, T.; Carpenter, S.R.; Alberti, M.; Folke, C.; Moran, E.; Pell, A.N.; Deadman, P.; Kratz, T.; Lubchenco, J.; Ostrom, E.; Quyang, Z.; Provencher, W.; Redman, C.L.; Schneider, S.H. and W.W. Taylor (2007): Complexity of coupled Human and Natural Systems. *Science* 317, 1513-1516, DOI: 10.1126/science.1144004.

Pahl-Wostl, C. and M. Hare (2004): Processes of social learning in integrated resources management. *Journal of Community and Applied Social Psychology* 14, 193-201

Contact:

Dr. Stefanie Christmann
ICARDA
P.O. Box 4564
Tashkent 100 000
Uzbekistan
s.christmann@cgiar.org
www.icarda.org

Climate change induced vegetation shifts in Europe

Ágnes Garamvölgyi
University of Budapest, Faculty of Horticulture, Department of Mathematics and Informatics, Hungary

Objective of my research is to summarise observed and predicted impacts of climate change on vegetation distribution all over the world. Besides, need and possibilities of nature conservation should also be discussed. In my current presentation I focus on changes in distribution of woody plant species, communities and biomes in Europe.

Material and methods: Literature (including field studies, experiments and model simulations) available in Web Science was reviewed and main conclusions of the articles were summarized according to geographical regions.

Results:

1. In the Alps:

- An upward shift of the forest limit and tree line has been observed.
- Montane deciduous forests move toward a higher elevation, subalpine coniferous forests shift into the alpine belt and the nival belt is being colonised.
- Beech (*Fagus sylvatica*)-dominated forests are being replaced by oak (*Quercus sp.*)-hornbeam (*Carpinus sp.*) forests.
- Invasion by exotic laurophyllous species has been observed in Southern Switzerland.
- In some locations, collapse of forests can be expected due to increasing drought.

2. In Scandinavia:

- Rise of the tree limit has been observed in Northern Europe as well.
- Boreal forests extend northward and to higher elevations.
- A shift in dominance from Scots pine (*Pinus sylvestris*) to deciduous broadleaved trees is going on.
- Non-native tree species, such as Norway maple (*Acer platanoides*) emerge in some locations.

3. In Western Europe:

- Forest transformation from Norway spruce (*Picea abies*) to European beech has been observed; spruce stands are predicted to move upwards and lose area in Southern Germany.
- Drought tolerant species are expected to replace beech in Eastern Germany.
- Heathlands may be replaced by grasslands and bracken.

4. In Southern Europe:

- Overall decrease of forest cover is expected due to water shortage and increasing fire risk.
- Dieback of Scots pine, European black pine (*Pinus nigra*) and European beech is forecast.
- As a consequence, pine dominated forests shift to broadleaf (oak) dominated forests.
- Upward shift of species has been observed, along with decreasing alpine vegetation.
- Invasion is likely on the islands of the Mediterranean Basin.

5. In Central Europe:

- An observed phenomenon is the upward shift of vegetation belts and tree line.
- Coniferous forests might be converted to deciduous forests.
- Distribution of mesic beech and Dinaric fir (*Abies alba*)-beech forests is expected to decrease, while that of thermophilous forests is predicted to increase.
- Increasing distribution of dwarf pine (*Pinus mugo*) has been observed.

6. In Russia:

- Conifer species are predicted to retreat northwards and to higher elevations.
- Thus, tundra may be invaded by the taiga.
- Distribution of larch (*Larix sp.*) is expected to shrink, while that of deciduous broad-leaved trees is predicted to increase.
- A new biome type: scrubland may appear, and forests may be replaced by steppe or bogs in some locations.
- Upward shift of the tree line has also been observed as well as shrub expansion in the Arctic.

Conclusion: In Europe, the Alps and Southern Europe are the most vulnerable regions regarding the impacts of climate change on vegetation, the former due to above-average rate of warming and the latter owing to increasing drought. Endemic species are especially endangered in these locations, and in the mountains the phenomenon of “summit traps” may also lead to species extinction. Conservation actions should aim for increasing resilience of ecosystems, and adaptation strategies should be ecosystem- and location-specific. The below listed methods are known so far, however, their implementation is often ignored and they should be refined as well.

- Reducing other threats (e.g. habitat fragmentation, habitat destruction, pollution, alien species)
- Expansion of reserve systems.
- Creation of ecological corridors in order to enable species migration and thus to maintain connected and genetically diverse populations.
- Conservation of endangered species in managed gardens where competition from other plants is excluded.
- Translocation of certain species.
- In hot and dry areas, fire protection or controlled burning in order to reduce fire risk.
- Restoration of destructed habitats and creating new ones.
- By means of forest management, adapting the composition of forests to changing climate.

Reference

Garamvölgyi, Á.; Hufnagel, L. (2013): Impacts of climate change on vegetation distribution No. 1. Climate change induced vegetation shifts in the Palearctic region. – Applied Ecology and Environmental Research 11(1): 79–122.

Contact

Ágnes Garamvölgyi
Corvinus University of Budapest, Faculty of Horticulture, Department of Mathematics and Informatics
Villányi út 29–43.
H-1118 Budapest
Hungary
garamvolgyiagi@gmail.com

Climate Change, Forest dynamics and Consequences for forest management in North Rhine-Westfalia

Norbert Asche
Landesbetrieb Wald und Holz NRW, Germany

In any environment climatic and edaphic conditions form manifold mosaics of different sites and ecosystems. In this presentation the potential impact of climate change on forest sites and site-adapted tree species will be discussed within the framework of forest site classification. As climate is generally one of the fundamental factors governing forest sites and therefore forest ecosystems, modification of climate parameters such as temperature and precipitation allow for an in-depth study of the spatiotemporal dynamics of forest site development and the resulting changes in forest types.

Using GIS technology the spatiotemporal dimensions of climate change scenario results can be visualised in map form allowing for further exploration of potential impacts of climate change on tree species, forest sites and forest types. In the presentation the potential development of forests and site-adapted trees in the “Sauerland” region of the federal state of North-Rhine Westphalia, Northwest Germany will be evaluated.

4.10 Interactive Session VI: Peatland ecosystems

Restoring peatlands in Russia – for fire prevention and climate change mitigation: framework for integrative peatland ecosystem management

Hans Joosten, Andrey Sirin, Tatiana Minayeva, Marcel Silvius, Sebastian Schmidt

Greifswald University, Institute of Botany and Landscape Ecology; Institute of Forest Science, Russian Academy of Sciences; Wetlands International; Michael Succow Foundation

Peatlands (>0.3 m depth) cover over 8% of Russia's territory and more than 20% when shallow peat areas (<0.3 m depth) are included. In the European part of Russia, over five million hectares of peatland have been drained for forestry, agriculture and peat extraction. Forestry on drained peatland was only partly effective and large areas are not managed anymore. Many forest stands are over-aged and subject to wind-throw and other degradation processes. In addition, large areas of peatland drained for agriculture have been abandoned. Since the early 1990s between 250,000 and 800,000 ha of peat extraction sites – often with a substantial remaining peat layer – have furthermore been given up, lay currently bare with little vegetation recovery and suffer from wind and water erosion. All these areas cause large carbon dioxide emissions from microbial peat oxidation and are vulnerable to fire.

By re-wetting drained peatland, vulnerability to fire and peat oxidation are substantially (or even totally) reduced. Regeneration of natural peatland ecosystems brings back important ecosystem services, such as biodiversity conservation, water regulation and carbon sequestration, whereas paludiculture (sustainable wet peatland agriculture) can make the areas productive again.

The project 'Restoring peatlands in Russia – for fire prevention and climate change mitigation' provides a framework for integrative peatland ecosystem management, including

- a detailed inventory of peatland status of (incl. recent changes in hydrology and water management infrastructure),
- a baseline study of GHG emissions and fire risk,
- capacity building for peatland management, rewetting and monitoring,
- rewetting of drained peatlands (in cooperation with the local authorities),
- assessing the effectiveness of the rewetting and
- sustaining best practices in methodologies and legislation.

The project will provide pilot cases for climate change mitigation projects via peatland restoration in Russia by developing the three pillars of mitigation: restoration, monitoring, and accounting.

The German-Russian technical cooperation project is coordinated by the German Ministry of Environment, Nature Conservation and Nuclear Safety and the Ministry of Nature Resources and Environment of the Russian Federation under the framework of the International Climate Initiative implemented by the KfW Entwicklungsbank and executed by Wetlands International with the Michael Succow Foundation, the Institute of Botany and Landscape Biology of Greifswald University, the Institute of Forest Science of the Russian Academy of Sciences and Moscow Province Government as partners.

Peatland biodiversity conservation will mitigate climatic change impacts in the European North-East of Russia

S. Zagirova, O. Mikhaylov
Institute of biology Komi SC UrB RAS, Syktyvkar, Russia
Project UNDP/GEF PA Komi Republic

The peatlands occupy 9% of Komi Republic area. In the climate change conditions the system of protected territories plays an important role in biodiversity conservation of peatland landscapes. The protected area includes 112 mire reserves which cover about 560 thousand hectares (about 17.5% of the total mire area in the Komi Republic) (Degteva and Goncharova 2012). The flora of peatland communities is presented by about 70 species of vascular plants and 60 species of mosses. According to the long-term observations and model calculations the climate change in Arctic and Sub-Arctic latitudes goes faster and more intense, than in the other regions of planet. In Russia the average annual temperature in the surface layer of the atmosphere increased by 1.29 °C from 1907 to 2006 (Otsenochnyy doklad … 2008). Within the framework of UNDP in Russia and the International Climate Initiative the investigations of biodiversity and carbon dioxide fluxes of the peatland ecosystems in the boreal zone of Komi Republic were conducted. In oligotrophic peatland ecosystems of the middle taiga the first 30 cm of the soil stores 1800 g m^{-2} of carbon and in undisturbed conditions they are characterized by steady carbon dioxide sink. The eddy-covariance measurements identified a relationship between the carbon dioxide accumulation and the vegetation development during the vegetation period. In the conditions of middle taiga zone of Komi Republic the average duration of the vegetation period is 158 days. The most intensive CO_2 uptake in peatland ecosystems was observed in July at the maximum development of green plants. In the meso-oligotrophic peatland the relationship between *NEE* and photosynthetic active radiation (PAR) intensity and soil surface temperature in summer and autumn periods was identified (Fig. 1)

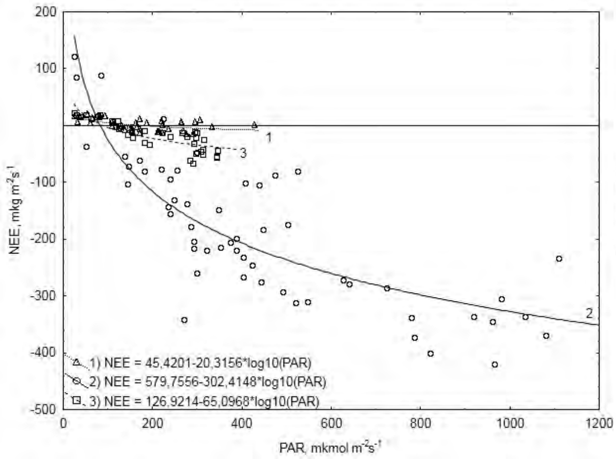


Fig. 1. The *NEE* dependence on PAR intensity: April 18-19, 2011, R^2 = 0.32 (1), July 16-17, 2012, R^2 = 0.71 (2) and October 3-4 2010, R^2 = 0.69 (3)

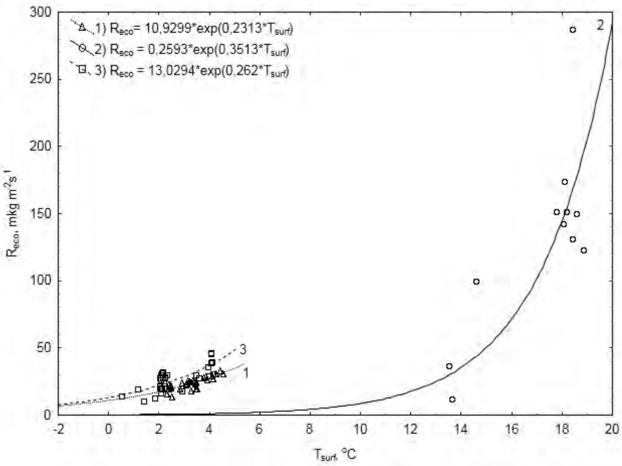


Fig. 2. The R_{eco} dependence on T_{surf}: April 18-19, 2011, R^2 = 0.61 (1), July 16-17, 2012, R^2 = 0.70 (2) and October 3-4 2010, R^2 = 0.54 (3)

The ecosystem respiration (R_{eco}) is characterized by high sensitivity to temperature. In summer period the soil surface temperature (T_{surf}) increased from +14 to +19 °C resulting in an increase of the ecosystem respiration of 7 times (Fig. 2). In spring and autumn when the T_{surf} increased from 0 to 4 °C, R_{eco} also increased in 2-4 times. In the early spring and late autumn the ecosystem respiration contributed the main part to the sum of vertical CO_2 fluxes between the peatland and the atmosphere. The annual balance of the net CO_2 exchange in boreal bogs is positive and reaches a sink of -225 g m^{-2}, however, the global warming could lead to increased emissions of CO_2 and turning mires into a powerful source of carbon dioxide to the atmosphere. Violation of vegetation as a result of human activities in peatland ecosystems can also lead to increased emissions of carbon into the atmosphere (Joosten and Sirin 2011). The preservation and expansion of peatland reserves in the conditions of anthropogenic pressure will mitigate the impact of climate change on biodiversity and carbon sinks in the whole region.

References

Degteva, S.V.; Goncharova, N.N. (2012): Problems of mire ecosystems protection in the Komi Republic // Izvestiya Komi naychnogo tzentra Uro RAN. № 2 (10). pp. 29-35.

Otsenochnyy doklad ob izmeneniyakh klimata i ikh posledstviyakh na territorii Rossiyskoy Federatsii. M. Rosgidromet, 2008. 29 s.

Joosten, H.; Sirin, A. (2011): The role of peatlands in carbon cycling and climate regulation // Carbon pools and fluxes in boreal forest and peatland ecosystems. Syktyvkar. pp. 6-7.

Contact

Svetlana Zagirova
Institute of Biology Komi SC UrB RAS
Kommunisticheskaya st.
Syktyvkar, 167982
Russia
zagirova@ib.komisc.ru
www.ib.komisc.ru

Exploring resilience concept for fen ecosystems: can we predict long-term effects of current conservation approaches?

Wiktor Kotowski, Ewa Jabłońska

Department of Plant Ecology and Environmental Conservation, Institute of Botany, Faculty of Biology, University of Warsaw, Centre of Biological and Chemical Research, Poland

Rich fens can exist as entirely natural systems, while in other situations they depend on vegetation management, which prevents succession. The stability of hydrologically intact fens reflects their high resilience capacity. However, this resilience can brake when environmental changes reach a certain threshold. The acidification and expansion of trees observed on rich fens may largely have arosen from such a loss of resilience due to human-induced drainage and eutrophication. Therefore, mowing or cutting have become a standard approach to maintain biodiversity related to open wetlands. Such a strategy is not sustainable on a longer time-scale, especially given uncertainty of climate and economical scenarios. Whether and how one can re-establish natural resilience in semi-natural fens appears therefore as the main unanswered question in fen ecology. Using examples from Biebrza Valley (EU-largest fen complex) and other Polish fens, we call for developing an ecosystem-approach to fen conservation, grounded in the resilience and wilderness concepts.

Contact

Wiktor Kotowski, Ewa Jabłońska
Department of Plant Ecology and Environmental Conservation, Institute of Botany, Faculty of Biology, University of Warsaw, Centre of Biological and Chemical Research
Al. Żwirki i Wigury 101
02-089 Warszawa
Poland

Economic and legal conditions for sustainable peatland management in Germany

SIMONE WITZEL, THEODOR FOCK
University of Applied Sciences Neubrandenburg, Germany

Protection, restoration, and rewetting of peatlands is crucial for nature conservation, biotope protection, and mitigation of greenhouse gases (GHG) since pristine peatlands are valuable biotopes and important water and nutrient sinks, especially for carbon.

According to various estimations, the total peatland area in Germany makes up 1.4 to 1.8 million ha (Jensen et al. 2012, SRU 2012). Only very few peatland areas can still be regarded as pristine. In the past, most of the peatlands (95%) were drained to expand the agricultural area and are still used for agricultural purposes. Drainage of peatlands leads to increasing GHG-emissions, especially carbon dioxide (CO_2) and nitrous oxide (N_2O). Thus, rewetting of peatlands and preservation of natural conditions contributes to important climate protection goals which can furthermore be reached more cost effectively than other measurements.

Despite the above mentioned manifold benefits of peatland protection, Germany still lacks a general peatland protection policy and obliging regulations. Up to now, there are only a few declarations of intent like “The National Strategy on Biological Diversity” released by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU 2007), a position paper by nature protection administrative agencies of several federal states (Jensen et al. 2012) and a suggestion by the German Advisory Council on the Environment to introduce a federal initiative on peatland protection (SRU 2012).

Furthermore, the fact of lacking a general peatland protection policy is mainly due to the federal system in Germany. The German federal states have their own nature protection policies adapted to their specific regional situation. Some federal states like Mecklenburg-Western Pomerania, Schleswig-Holstein, Lower Saxony, Brandenburg, and Bavaria introduced their own peatland protection policies. Most of these policies promote cessation of agricultural and other usage. The different peatland protection programs have various durations, intensities, and financial strategies. They are mostly rewetting projects with limited regional scale financed by means of federal and national budgets, EU cofinancing, and/or impact regulation under nature protection law (Ullrich & Riecken 2012). Moreover, Mecklenburg-Western Pomerania and Brandenburg introduced so called MoorFutures© to finance rewetting projects. These are shares which shall be bought by private people or companies as voluntary verified emission certificates. They are a simplified way to value ecosystem services (Permien & Ziebarth 2012).

As mentioned above, most of the German peatlands (ca. 1.3 million hectare) are used as agricultural land. Their share makes up 8% of the total agricultural area. These agriculturally used peatlands emit approx. 42.8 Mt $CO_{2\text{-eq}}$, which is one third of the total GHG-emissions caused by agriculture in Germany (SRU 2012). Thus, climate-related peatland protection schemes need to include agriculture and its policy and legal conditions. The introduction of site adapted and peat protecting concepts like extensive grazing and paludicultures (Latin *palus* = swamp) has to be examined. Paludiculture is defined as “wet agriculture” and offers possibilities to manage peatlands responsibly and yet preserve the stored carbon. Reed beds and other typical wetland plants shall be harvested with site adapted machinery and shall be used for building and energetic purposes.

Economic and ecological sound incentives have to be identified to promote a conversion to paludiculture. To gain the acceptance of farmers and land-owners, direct payments of the First Pillar of the CAP or payments of agri-environmental schemes should be maintained. Direct payments are only granted for agricultural land, which is used for agricultural purposes. Since only agricultural plants can be funded according to the CAP subsidy scheme, the most important prerequisite is the approval of reed as an agricultural plant. Furthermore, rewetted areas might lose their status as agricultural land. However, some legal conditions hinder the introduction of paludicultures, for instance the German biotope protection scheme which prevents the harvesting of reed. In addition, reed bed harvesting is limited according to regulations for species conservation. Since without subsidies and direct payment schemes an introduction of paludicultures on large scales might be impossible, political awareness has to be risen.

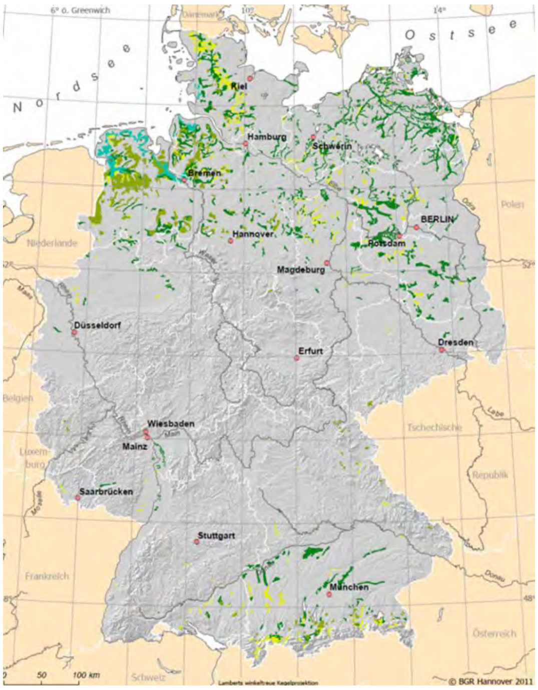


Figure 1: Destribution of peatland area in Germany. Source: Digitales Archiv FIS Bo BGR: BÜK 1000N, Vers. 2.3 (version 2007)

References

BMU (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) (publisher) (2007): Nationale Strategie zur biologischen Vielfalt. Eigenverlag, Berlin, Germany, 178 pages.

Jensen, R.; Landgraf, L.; Lenschow, U.; Paterak, B.; Permien, T.; Schiefelbein, U.; Sorg, U. M.; Thormann, J.; Trepel, M.; Wälter, T.; Wreesmann, H. and Ziebarth, M. (2012): Potentiale und Ziele zum Moor- und Klimaschutz, Gemeinsame Erklärung der Naturschutzbehörden, Eine Vision für Moore in Deutschland, Flintbek, Schleswig-Holstein, Germany. 38 pages.

Permien, T. and Ziebarth, M. (2012): MoorFutures – innovative financing of peatland rewetting projects in Mecklenburg-Western Pomerania, Germany, In: Natur und Landschaft – Zeitschrift für Natur und Landschaft, 87. Jahrgang (2012), Heft 2, pp. 77 – 80.

SRU (Sachverständigenrat für Umweltfragen - German Advirory Council on the Environment) (2012): Umweltgutachten 2012 - Verantwortung in einer begrenzten Welt, Berlin, Germany, 716 pages.

Ullrich, K. and Riecken, U. (2012): Bog and fen conservation strategies, initiatives and programmes in Germany, In: Natur und Landschaft – Zeitschrift für Natur und Landschaft, 87. Jahrgang (2012), Heft 2, pp. 81 -86.

Contact

Simone Witzel
University of Applied Sciences Neubrandenburg, Department of Agriculture and Food Sciences
Brodaer Str. 2
Neubrandenburg, 17033
Germany
witzel@hs-nb.de

Theodor Fock
University of Applied Sciences Neubrandenburg, Department of Agriculture and Food Sciences
Brodaer Str. 2
Neubrandenburg, 17033
Germany
fock@hs-nb.de

4.11 Interactive Session VII: Connecting with people – why biodiversity conservation makes sense in a changing climate

Prudence, Justice and the Good Life: Ethical foundations of biodiversity communication

UTA ESER
Centre for Economics and the Environment, Nuertingen-Geislingen University (NGU), Germany

Communication is considered key to the implementation of the UN Convention on Biological Diversity (CBD). To improve biodiversity communication, the German Federal Agency for Nature Conservation commissioned the ethical expertise that is presented in this paper. Building on the conceptual triad "Prudence, Justice and the Good Life", the study analysed the German, Austrian, Swiss and EU biodiversity strategies (ESER et al. 2013). The three categories comprise different kinds of answers to the question why conservation, sustainable use and fair sharing of benefits derived from biodiversity are reasonable policy goals:

- *Prudence* focuses the instrumental value of biodiversity for economy and society.
- *Justice* refers to matters of responsibility and moral obligations.

The *Good Life* points to the eudemonic value of biodiversity, i.e. to those aspects of biodiversity that are valuable beyond any use options.

While conceptual questions are addressed in part one of the report, key findings are presented in part two: Using significant slogans as headlines, three different chapters illuminate the particular relevance and limitations of the respective arguments.

"Our life insurance, our natural capital": The title of the EU biodiversity strategy represents the currently favoured prudential argumentation. We critically discuss the ecosystem services approach, identify the contested meaning of 'instrumental value' as major source of misunderstandings and sketch conceptual limits of the economic framework.

"We are all in this together": This headline of the EU strategy illustrates how different and competing interests can be concealed behind a collective rhetoric. We discuss conflicts of interests not only between current and future generations and between humans and nature, but also among different people living today. Where the satisfaction of the interests of particular people compromises the satisfaction of the needs of others, moral considerations are called for.

"Living in harmony with nature": This vision of the Strategic Plan adopted in Nagoya is presented as a typical argument of the Good Life. Although subjective attitudes like respect, awe and wonder cannot be prescribed and do not set specific limits to human actions, they are recommendable and valuable sources of ethical commitments.

In contrast to the predominantly strategic use of the term "communication", we support HESSELINK et al. (2007) in regarding communication as a two-way-process aimed at mutual understanding. As a result, the last chapter presents recommendations for a communication that takes this aim seriously.

From individual to generic self-interest: Communication needs to acknowledge that collective and individual interests can fall apart. The legitimate quest for a tailored communication may not cloud conflicts of interests.

From “we” to “who” and “how: In order to address issues of fair and equitable sharing, costs as well as benefits of biodiversity conservation must be specified: Who is going to benefit in which way? How can costs and benefits be distributed in a fair manner?

From facts to values: Instead of sticking to putatively hard facts, communication should encourage debate about subjective values and concepts of a Good Life.

From intrinsic value to ethics: Ethical aspects should not be restricted to the contested question if non-human beings do have intrinsic moral value or not. All kinds of arguments – Prudence, Justice, and the Good Life – rest on ethical assumptions that can and need to be overtly addressed in communication.

References

ESER, U.; NEUREUTHER, A.; SEYFANG, H. & MÜLLER, A. (2013): Prudence, Justice and the Good Life. A typology of ethical reasoning in selected European national biodiversity strategies. A study on behalf of the German Federal Agency of Nature Conservation. Bonn. − URL: http://www.bfn.de/0309_ethik.html

HESSELINK, F.; GOLDSTEIN, W.; VAN KEMPEN, P.P.; GARNETT, T.; DELA, J. (2007): Communication, Education and Public Awareness (CEPA). A Toolkit for National Focal Points and NBSAP Coordinators. Secretariat of the Convention on Biological Diversity and IUCN, Montreal, Quebec, Canada. – URL: http://www.cbd.int/cepa/; 09.12.2011

Contact

Dr. Uta Eser
Center for Economics and the Environment
Nuertingen-Geislingen University
Schelmenwasen 4-8
Nürtingen, 72622
Germany
uta.eser@hfwu.de
www.kowu.hfwu.de

Navigating in a sea of risks: MARISCO, a conservation planning method used in risk-robust and ecosystem-based adaptation strategies

Stefan Kreft, Daniela Aschenbrenner, Christoph Nowicki, Steffen Reichle, Lena Strixner, Peter Hobson, Pierre L. Ibisch

Centre for Econics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development (Univ. of Appl. Sc.); Fundación para la Conservación del Bosque Chiquitano; Centre for Econics and Ecosystem Management, Writtle College, University of Essex

Climate change-related problems of a global scale are matched by the impacts of dynamically changing socio-economic factors, and together they contribute to dramatic losses in biodiversity and ecosystem function as well escalating uncertainty. These new challenges force nature conservation to make adjustments in the trade-off between operational and strategic activities. Many conservation practitioners are faced with the task of managing an exponential rise and increasing complexity in the number of urgent problems. Whilst preoccupied with reactive intervention, managers are distracted from developing much needed proactive strategies that would allow for effective preparation for longer term risks.

MARISCO (Spanish acronym, meaning adaptive risk and vulnerability management at conservation sites) is an ecosystem-based planning instrument that merges both reactive and proactive approaches into one adaptive management cycle. It is not a 'cook book' to conservation, but stands on a theoretical fundament of ecosystem and complex systems theories as well as non-equilibrium thermodynamics.

Application of MARISCO produces a set of concrete outcomes:

- A situation analysis of the conservation site. This analysis sets out with a definition of the conservation objects (ultimately the local ecosystems and the services they provide). All stresses they suffer from as well as the anthropogenic threats that cause them and underlying factors are mapped and assessed regarding their actual and potential future criticality.
- The geographical scope of management. Based on the systemic situation analysis, it is aligned to natural borders as well as management tasks that arise from human activities (threats that cause them and underlying factors).
- An ecosystem-based conservation strategy. This overall strategy is comprised of more specific strategies that will take place on action levels such as tangible manipulation of biodiversity, institutional improvements, political work, monitoring, or communication. All strategies are designed to reduce risks and vulnerability included in the conservation system. Existing and new strategies are evaluated according to ten criteria that attempt to capture risks and opportunities regarding their feasibility and their impact.

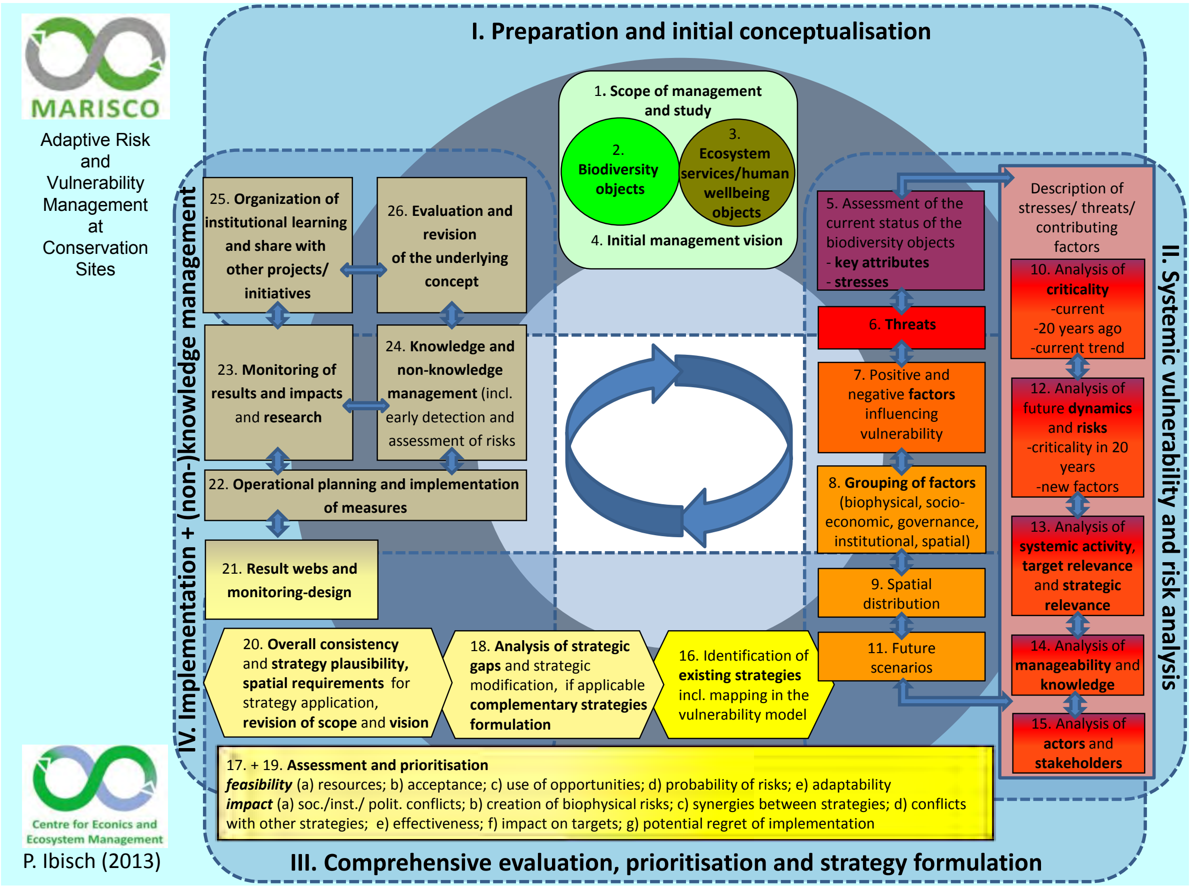


Figure 1: One full MARISCO nature conservation management cycle consists of a logical sequence of 26 working steps comprised in four major phases: I. Preparation and initial conceptualisation, II. Systemic vulnerability and risk analysis, III. Comprehensive evaluation, prioritisation, and strategy formulation, and IV. Implementation and (non)knowledge management.

MARISCO planning exercises aim at activating knowledge and generating understanding of ecosystem-based management. This includes help in capturing approaches to adaptive and systematic participatory (consensual) planning. It strengthens professional skills, or encourages their development, such as team work, leadership, documentation and communication. Past and current applications of MARISCO stem from Germany, Ukraine, and United Kingdom as well as a number of countries outside Europe.

A comprehensive English guidebook on MARISCO for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) will be finalised in the course of the year 2013.

Further information:

http://www.centreforeconics.org/publications-and-products/adaptive-conservation-and-vulnerability-marisco/

References

Geiger, L.; Kreft; S. & P.L. Ibisch: Reducing blindspots: MARISCO, a planning approach that integrates risk management into biodiversity conservation. 153-212. Ibisch, P.L.; L. Geiger & F. Cybulla (eds., 2012): Global change management: knowledge gaps, blindspots and unknowables. Nomos, Sinzheim.

Contact

Stefan Kreft
Centre for Econics and Ecosystem Management, Faculty of Forest and Environment,
Eberswalde University for Sustainable Development (Univ. of Appl. Sc.)
Alfred-Moeller-Str. 1
D-16225 Eberswalde
Germany
Stefan.kreft@hnee.de
www.centreforeconics.org/

The role of migratory animals in raising public awareness of the biodiversity-climate change nexus

JOHANNES STAHL, DANIEL KACHELRIESS
UNEP/CMS Secretariat

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is a multilateral environmental agreement with 119 parties. It contains both legally-binding and non-legally binding instruments to conserve migratory species throughout their migratory range. For the purposes of the convention, migratory species are defined as species of which a significant proportion "cyclically and predictably" crosses one or more national boundaries.

We argue that migratory species are powerful vehicles for communication of environmental problems and threats to biodiversity, especially climate change. Migratory species, through their transnational migrations connect countries and peoples, who must work together for successful conservation.

Charismatic animals are frequently used to lobby for biodiversity conservation. Widely known examples include the Panda for WWF, the Elephant for CITES, or the Polar Bear for Coca Cola.

Yet, there are also other, far less known (migratory) species that can become powerful vehicles for communication due to their astonishing feats:

The Bar-Tailed Godwit (*Limosa lapponica)* is a bird that flies annually – without pause – approximately 12,000 km from the Arctic to its wintering grounds in Africa, Asia, and Australia. This is both the longest non-stop flight and the longest journey without feeding undertaken by any animal.

The Arctic Tern (*Sterna paradisaea*) is a bird holding the title for the longest overall migration annually, from the Arctic to Antarctica and back, covering some 70,000 km.

The Monarch Butterfly (*Danaus plexippus*) is a small insect that flies up to 3,600 km annually from Mesoamerica to the U.S.

For climate change specifically, there are many examples of species that are, or could be, used in effectively communicating threats to biodiversity to a wider audience:

The polar bear (*Ursus maritimus*) is already the flagship species for climate change. Currently, there is an ongoing discussion under CMS about listing the polar bear on the Convention's appendices.

Marine turtles (e.g. the green turtle *Chelonia mydas*) are often used as ambassadors for ocean pollution, but a little known fact is that these species are also threatened by climate change in a very peculiar way. Marine turtle eggs require specific nest temperatures for incubation and the temperature of the sand determines the sex of the offspring. Cool beaches produce predominantly male and warm beaches mainly female hatchlings. Increasing temperatures lead to a feminizing of turtle populations.

The West African Manatee (*Trichechus Senegalensis)* lives in deep, slow moving river water. The species is highly charismatic, and under threat because of the increase of extreme precipitation events, as both high and low rainfall can lead to isolation of these animals in channels separate from the river flow. There, overheating often results in mass mortalities. The special charm of this species has made one individual a YouTube-star already, with more than 2 million views over the course of a few weeks.

The Parties to CMS have adopted Resolution 10.19 on Migratory Species Conservation in the Light of Climate Change. The resolution recognises the adverse impact of climate change on migratory species, and urges parties to incorporate tackling the effects of climate change in their efforts to conserve migratory species. Pursuant to Resolution 10.19 and other mandates, the CMS Secretariat is conducting activities to raise awareness of climate change impacts on biodiversity, using migratory species as vehicles for communication. Examples include awareness raising campaigns, such as the annual “World Migratory Bird Day” and the “Year of … Campaigns” (e.g. Year of the Bats 2011-2012), all of which include attention to climate change- related threats.

References:

CMS Resolution 10.19 (2011): Migratory Species Conservation in the Light of Climate Change.

UNEP/CMS Secretariat (2006): Migratory Species and Climate Change: Impacts of a Changing Environment on Wild Animals. Bonn, Germany.

Contact

Dr. Johannes Stahl
UNEP/CMS Secretariat
UN Campus, Platz der Vereinten Nationen 1
Bonn, 53113
Germany
JStahl@cms.int
www.cms.int

Eight steps to consistent adaptation

Olly Watts
RSPB / BirdLife International

Integrating climate change adaptation across all an organisation's activities is vital for successful longer term conservation delivery. The RSPB has developed a simple, effective framework for consistent assessment across practical and policy activities.

We use average global temperature rises of 2°C and 4°C as the base for assessing climate change. This links with mitigation aims and the real world, using everyday language and freeing adaptation from hypothetical emissions scenarios. We expect a 2°C world to be with us around 2040. This milestone provides a practical planning horizon of around 25 years, yet our plans can easily be adjusted if real-world climate change occurs faster or slower than expected. The 4°C world shows long term direction and reinforces mitigation work, to avoid these impacts. We use UKCP09 climate projections at 25 km resolution for seasonal temperature and precipitation for these global scenarios.

Our assessment and adaptation actions are framed around vulnerability, the combination of exposure and sensitivity to climate change, rather than risk. Impacts for biodiversity are typically gradual and cumulative (albeit with weather extremes and shocks) and usually require ongoing change management responses, rather than one-off risk management approaches. This does not exclude options of risk-oriented infrastructure such as reservoirs to increase water holding capacity at natures and soft, habitat-based flood defence schemes.

Eight steps guide users through climate change adaption assessment:

1. List objectives of the work area
2. Find out how climate is expected to change, relevant to the work area
3. Assess how climate change will affect objectives, activities, operations. This looks at both direct climate impacts, and how the adaptation of other interests may indirectly affect our objectives
4. Prioritise key threats and opportunities
5. Explore range of strategies and actions to address the priority impacts and opportunities
6. Agree actions to be taken and revise operations
7. Monitor, review effectiveness of actions in adaptive management cycle
8. Communications to key audiences

We use these assessment steps primarily to provide scoping, towards embedding climate change into ongoing nature management, rather than to produce a 'final' study and report. As such, the assessment can mix qualitative and quantitative inputs appropriate to particular situations, and may often identify research needs and knowledge gaps, rather than produce a definitive adaptation account.

Attention is given to making the adaptation process accessible and easy for all RSPB staff to engage with. The eight steps are the central part of a comprehensive adaptation toolkit with its own dedicated intranet area. Engaging stakeholders is paramount and a workshop, with a prepared format, is central to the process. Four tables collate the information and a summary template provides concise and consistent adaptation reports, that build to form the organisation's response. An information centre provides the climate projections, biodiversity impacts and adaptation knowledge needed for non-experts to address adaptation successfully, with further training and support available.

Our adaptation actions are guided by complementary strategies of building resilience and helping to accommodate natural change. The former largely seeks to build strong populations where they currently occur, the latter helps them to shift range as the location of suitable climate shifts. Both strategies may build on and enhance the natural, autonomous adaptation of biodiversity. Adaptation will be ongoing, with no end point, and should reflect the increasingly dynamic natural environment. Within the broad trends of climate change, extreme and chaotic weather will become more common, and the range of possible conditions within the climate change projections adds further to the uncertainty around which adaptation decisions must be made. No-regret actions, compatible with all aspects of the uncertainty, are sought and early actions, ideally developed in partnerships, are usually considered more effective and less costly than holding off taking action to the future.

Climate change adaptation is now a fundamental part of the RSPB's nature reserve's strategy and a component of every reserve's regular management review. We are embedding climate change adaptation assessments and strategies across our whole conservation programme, saving nature for the long term.

Contact

Dr Olly Watts
RSPB
The Lodge
Sandy, Bedfordshire SG19 2DL
England, UK
olly.watts@rspb.org.uk
www.rspb.org.uk

4.12 Interactive Session VIII: Adaptation Planning

A decision framework for considering climate change adaptation in biodiversity conservation planning

TOM H. OLIVER RICHARD J. SMITHERS, AND KEVIN WATTS
Centre for Ecology & Hydrology, Ricardo-AEA Ltd., Forest Research, UK

Climate change adaptation principles for biodiversity have been formulated for conservation managers. However, a lack of understanding of how to prioritise and target these principles may be inhibiting their implementation. We present a decision framework to promote integration of the principles into conservation planning (Oliver et al. 2012). The framework prioritises actions to remove existing threats to species before improving functional connectivity across landscapes. We demonstrate its rapid deployment at a national scale on 30 UK priority species by relying on readily accessible and easily interpreted sources of information. We find that compared with existing conservation priority actions the framework prioritises a wider suite of actions that also address projected future climate space. We anticipate that, in combination with consideration of socio-economic and local factors, the decision framework will be a useful tool for conservation managers to integrate adaptation measures into their plans.

References

Oliver, T.H.; Smithers, R.J.; Bailey, S.; Walmsley, C.A. & Watts, K. (2012): A decision framework for considering climate change adaptation in biodiversity conservation. *Journal of Applied Ecology,* **49,** 1247-1255

Contact

Tom H. Oliver
Centre for Ecology & Hydrology
Maclean Building
Benson Lane
Crowmarsh Gifford Wallingford
Oxfordshire
OX10 8BB, UK

.

Legal Aspects of Connectivity Conservation: Key tools for nature conservation and climate change

Barbara J. Lausche, JD

Member IUCN World Commission on Environmental Law (WCEL) and World Commission on Protected Areas (WCPA); Director, Marine Policy Institute, Mote Marine Laboratory, Sarasota, FL USA; Lead author for Legal Aspects of Connectivity Conservation, Volume 1 – A Concept Paper (IUCN 2013), a complement to IUCN Guidelines for Protected Areas Legislation (Lausche 2011)

Context: Connectivity conservation and the management of connectivity conservation areas are emerging fields of scientific study and conservation management practice within the broader subject of nature conservation. In the most basic terms, connectivity conservation is a conservation measure in natural areas that are interconnected and in environments that are degraded or fragmented by human impacts and development where the aim is to maintain or restore the integrity of the affected natural ecosystems, linkages between critical habitats for wildlife, and ecological processes important for the goods and services they provide to nature and people. In fragmented ecosystems, wildlife corridors and other natural linkages such as green belts and large wildlife corridors have been common representations of connectivity conservation.

Presentation: In contrast to advancing science, the field of law with respect to connectivity conservation is still being defined and developed. This presentation is based on conceptual work undertaken during 2011-2012 for a project, 'Protected areas law at the intersection of biodiversity conservation and climate change', with a protected areas and climate change expert group directed by the IUCN Environmental Law Centre (ELC), in collaboration with IUCN's World Commission on Environmental Law, World Commission on Protected Areas, and Global Protected Areas Program, and supported by a grant from the BMZ. The purpose of the project was to explore the legal aspects of connectivity conservation for achieving biodiversity conservation and supporting the goals of protected areas. In light of climate change, the analysis also considered the role of connectivity conservation for building natural resilience areas and for climate change adaptation and mitigation. The project built upon and complements *IUCN Guidelines on Protected Areas Legislation* (Lausche 2011) (Guidelines), accompanied by 15 case studies, which set out key elements for modern protected areas legal frameworks, including for climate change adaptation. In addition, the project complements the IUCN-directed *Connectivity Conservation Management: A Global Guide* (Worboys et al. 2010), which synthesizes the latest scientific information on connectivity conservation and management.

The presentation gives highlights from the resulting project document, *Legal Aspects of Connectivity Conservation, Volume 1 – A Concept Paper* (Lausche et al. 2013), in its two main Parts: Part I on basic concepts and principles important to take into account in law (science and management, benefits derived, and special governance issues); and Part II on legal aspects, from global and regional law, to European Union law, and key national legal instruments. The national analyses included:

- Conservation and sustainable use legislation
- Land use planning and development control law
- Voluntary conservation agreements
- Economic and market-based instruments

- Special legal tools for the marine environment such as marine spatial planning, ocean zoning, and integrated coastal and marine management.

Key findings and results: The document concludes with several key messages and conclusions. The *overarching conclusion* is the need for countries to become increasingly alert to their connectivity conservation needs, undertake connectivity planning, and initiate actions using existing mechanisms and opportunities as much as possible to negotiate and protect critical connectivity areas before they are lost to development. A wide array of different legal instruments and tools already exist in many legal systems to begin to promote and implement science-based connectivity actions in priority landscapes/seascapes and local sites. *Key messages* include:

- The backbone of connectivity is still protected areas and responsive protected areas law.
- There is an urgent need to include connectivity conservation objectives in land use planning and development control laws.
- Economic and other incentives are critical to secure voluntary connectivity measures.
- Valuable national/regional lessons are already available; more training and case studies needed.
- The current and growing challenges of climate change make action urgent.
- Law must include tools for flexibility to adapt to changing management needs and scientific understandings.

Five case studies were developed as part of this project and are available with this publication (on CD). They either describe legal mechanisms available to effect connectivity in specific jurisdictions (European Union, the Netherlands, Brazil), or explain legal regimes or tools to create, maintain and manage specific connectivity zones (Australia: A2A; South Africa: The Greater Cedarberg Biodiversity Corridor).

The *IUCN Guidelines for Protected Areas Legislation* and this document, taken together, also are intended to be useful as teaching and training materials at university and practitioner levels through formal courses, e-learning tools, and special training workshops and seminars.

References (there is a full bibliography in the project document (item 2 below):

Lausche, B.; Farrier, D.; Verschuuren, J.; La Viña, A.G.M.; Trouwborst, A.; Born, C-H.; Aug, L. (2013): The Legal Aspects of Connectivity Conservation. Volume 1 - A Concept Paper. Gland, Switzerland: IUCN. Available online (forthcoming).

Lausche, B. (2011): IUCN Guidelines for Protected Areas Legislation. Gland, Switzerland: IUCN. Available at http://data.iucn.org/dbtw-wpd/edocs/eplp-081.pdf.

Worboys, G.L.; Francis, W.L. and M. Lockwood (2010): Connectivity Conservation Management: A Global Guide. London, UK: Earthscan.

Contact:

Institutional contact:
IUCN ELC
Sarah Lukas
Legal Officer
IUCN ELC
Bonn, Germany.

Author contact:
Barbara J. Lausche
4371 Oak View Drive
Sarasota, FL 34232 USA
blausche@comcast.net

Indicators of climate change impacts on biodiversity – A concept for the national level

Rainer Schliep, Robert Bartz, Rainer Dröschmeister, Frank Dziock, Silvia Dziock, Ingo Kowarik, Laura Radtke, Livia Schäffler, Stefan Siedentop, Christoph Sudfeldt, Ulrich Sukopp, Sven Trautmann and Stefan Heiland
Technische Universität Berlin, Department of Landscape Planning and Development, Berlin, Germany; Technische Universität Berlin, Department of Ecosystem Science / Plant Ecology, Berlin, Germany; Federal Agency for Nature Conservation, Bonn, Germany; University of Applied Sciences, Faculty of Agriculture/ Landscape Management, Dresden, Germany; University of Stuttgart, Institute of Regional Development Planning, Stuttgart, Germany; Federation of German Avifaunists, Münster, Germany

On behalf of the German Federal Agency for Nature Conservation (BfN), a research consortium is currently developing a comprehensive indicator system with the objective of monitoring the direct and indirect impacts of climate change on biodiversity in Germany and to highlight the need for further action in nature conservation and other policies. One of the main challenges in defining the indicators is to find a balance between scientific validity with the need for an easily understandable system, informing stakeholder dialogues on feasible adaptation and mitigation measures. The final indicator system should include pressure, state, impact and response indicators according to the DPSIR framework.

In the first two work packages of the project, climate change effects on biological diversity and nature conservation strategies as well as measures to adapt to climate change were reviewed. Further, we analysed comparable indicator systems such as the European Biodiversity Indicators (SEBI), the Climate Change Indicators of the European Environment Agency (EEA), indicators derived from the biodiversity monitoring programs of Switzerland (BDM-CH) and Austria (MOBI-e) and the UK Climate Change Indicators. A set of six criteria to evaluate the suitability of existing indicators and concepts for the development of new indicators was extracted:

Thematic relevance: The indicators must address a relevant key topic in the context of biodiversity changes caused by climate change. This includes the entirety of (direct and indirect) impacts of climate change on biodiversity.

Data availability and stability of data collection: The indicators should be based on precise data from permanent monitoring programs using scientifically sound and standardised methods. Data should cover the entire area of Germany and should be updated annually.

Relation to political objectives: The indicators should relate to politically agreed targets in order to inform about the (socially) desired direction of change.

Relation to politically controllable subjects: In general, the indicator subject should be controllable by policy measures. However, there are indicator subjects only controllable by policy measures exceeding national jurisdiction (e. g. the 2° C climate target).

Easy comprehension and clarity: Although the indicator system designed here is dedicated to serve an informed expert community, the indicators should be understandable, transparent and simple.

Finally, means of statistical analysis for the determination of indicator status and trend should be elaborated.

Indicators fulfilling these requirements are ideal instruments to provide political advice for stakeholders of nature conservation in the light of climate change. It is foreseen, that subsets of the modified or newly developed indicators should feed into the existing indicator system of the German National Strategy on Biological Diversity and into the currently compiled indicator system of the German Adaptation Strategy to Climate Change. The elaboration process was supported by input from a project steering group (PAG) and by an expert meeting in January 2013.

In a next step, relevant existing indicators and conceptual ideas for the development of new indicators were allocated to one of three indication areas:

(1) Changes of biodiversity resulting directly from climate change: This indication area tackles three thematic fields: (i) phenological changes of plant and animal species, (ii) changes in distribution, populations and biocoenoses, and (iii) changes of habitats.

(2) Emerging pressures on biodiversity caused by sectoral adaptation: Sectors considered are forestry, agriculture, and water management.

(3) Adaptation of nature conservation strategies and measures in the context of climate change: In this indication area we track (i) the adaptation of nature conservation policies and landscape planning to climate change, (ii) the implementation of adapted measures, and (ii) the effectiveness of such measures.

The present draft of the system will be further developed into a final set of approximately 20 to 25 indicators by summer 2014 forming the backbone of a BfN expert information system on climate change and biodiversity.

Conceptual challenges in this project encompass (1) linking changes of biodiversity to climate change, (2) lack of political control over many climate change impacts on biodiversity, and (3) deciding on the application of a more descriptive or a more evaluative approach concerning impacts of climate change on biodiversity.

Contact

Rainer Schliep
Technische Universität Berlin
Department of Landscape Planning and Development
Straße des 17. Juni 145
10623 Berlin
Germany
rainer.schliep@tu-berlin.de
http://www.landschaft.tu-berlin.de/

Assessing climate change risks and opportunities for species.

Pearce-Higgins, J.W.; Ausden, M.; Beale, C.; Bradbury, R.B.; Carroll, M.; Crick H.Q.P.; Duffield, S.; Macgregor, N.A.; McClean, C.; Morecroft, M.; Ockendon, N.; Oliver, T.; Savage, J.; Thomas, C.D. & Watts, O.
British Trust for Ornithology; Royal Society for the Protection of Birds; York Environmental Sustainability Institute, University of York; Natural England, Centre for Ecology and Hydrology

Climate change is regarded as a serious long-term threat to many species. Given increasing evidence that species distributions are shifting, populations and ecological communities changing in response to recent warming, there is an urgent need for conservation organisations and agencies to respond. A precursor to much adaptation, which until recently has been largely neglected, is that of species' prioritisation. Given limited conservation resources, at which species should conservation organisations target climate change adaptation?

In this paper we present an assessment of the risks and opportunities that climate change could pose for 3,048 plants and animals across 17 taxonomic groups to answer this question for England. This was achieved by comparing projected future changes in the potential distribution of species derived from bioclimate models, with recently observed population changes, using a basic framework based on Thomas *et al.* (2010). For a subset of these, we then considered the potential for confounding and exacerbating factors to affect species' responses, within the full Thomas *et al.* framework.

Using the basic framework, 640 species (21%) were classified as being at high risk from climate change under a 2 ˚C warming scenario, and 188 (6%) at medium risk. A greater number of species were projected to be likely to receive a medium or high benefit; 486 (16%) and 1,164 (38%) species respectively (Table 1). Under the more comprehensive full framework applied to 402 species, 35% of species assessed were classified at high or medium risk from climate change compared to 42 % likely to benefit. Although there was a strong correlation between the results of the two assessments for individual species, the full assessment better attributed recent change to climate change.

Table 1: Cross-tabulation of the risks and opportunities associated with climate change for all species, based upon a B1 projection for 2070-2099.

		RISK				
		VERY HIGH	**HIGH**	**MEDIUM**	**LOW**	**TOTALS**
OPPORTUNITY	**LOW**	25	1	7	6	39
	MEDIUM	614	157	481	84	1336
	HIGH	24	27	358	142	551
	VERY HIGH	56	44	662	360	1122
	TOTALS	719	229	1508	592	3048

A greater proportion of species of current conservation concern were regarded as being at risk than other species, suggesting that many priority species were likely to remain priorities under a changed climate. There was significant variation in the apparent vulnerability of different taxa to climate change. Bryophytes appeared to be at greatest risk, whilst the majority of hymenoptera were regarded as likely to benefit. A relatively even mix of species was classified in the ‘risk’ and ‘benefit’ categories for most other taxa. Species occupying upland habitats appeared to be particularly sensitive to climate change, where the majority were classed at high or moderate risk.

Our results suggested that the ability of many species to adapt to climate change may be constrained by other factors. As well as identifying priority species across taxa and habitats, the results were used to identify priority actions for conservation.

To our knowledge, this is one of the most comprehensive assessments of the impacts of climate change on biodiversity. The application of this framework was associated with a number of significant challenges, particularly for relatively poorly-recorded and poorly-understood species. However, the use of the basic framework allowed us to make assessments for a large number of species. The limitation of this basic approach was that the likely sensitivity to climate change of species whose populations have been driven strongly by non-climatic factors may be over-estimated. Given likely variation in the impacts of climate change across a species’ range, and across Europe, this approach could be usefully extended to other countries and regions, and to inform conservation priorities at a European level. This would enable national priorities to be set within a wider context.

Contact

Dr James Pearce-Higgins
British Trust for Ornithology
The Nunnery
Norfolk, IP24 2PU
UK
james.pearce-higgins@bto.org
http://www.bto.org/about-bto/our-staff/james-pearce-higgins

5 Abstracts of poster presentations

Remote sensing signals of erosion and plant diversity in the Greater Caucasus, Georgia

Martin Wiesmair, Annette Otte, Dietmar Simmering, Rainer Waldhardt
Center for International Development and Environmental Research (ZEU), Section I: Use of Natural Resources and Environmental Preservation, Justus-Liebig University, Giessen, Germany; Division of Landscape Ecology and Landscape Planning, Institute of Landscape Ecology and Resources Management, Justus-Liebig University, Giessen, Germany;

Scientists, national and international agencies have agreed upon the urgent need for the conservation of Georgian mountain ecosystems (NBSAP 2005). Over centuries, especially grassland management has created heterogeneous landscapes with high plant diversity. However, in the Georgian Greater Caucasus, intensive sheep husbandry damaged the vegetation cover and degraded soil stability during the Soviet period. Moreover, climate change and the illegal logging of protective forests have increasing negative effects on soil stability and biodiversity of Georgian mountain ecosystems (e.g. Nakhutsrishvili et al. 2009). To protect these ecosystems, interdisciplinary research on environmental and societal processes is necessary (Waldhardt et al. 2011). In 2010 the interdisciplinary research project AMIES (http://www.amies-net.org) studying the interrelationships between changes in land use, climate, erosion, biodiversity, and livelihood in mountainous regions of Georgia started at the University of Giessen.

In our study, the area of interest is located in the Kazbegi region next to the village Mleta. There, we aim to test relationships between plant diversity, nutrient availability, vegetation cover and canopy reflectance. Canopy reflectance can be used to determine floristic gradients in grasslands (Schmidtlein & Sassin 2004). In summer 2012 and 2013 plots were being sampled for soil, vegetation and hyperspectral reflectance. Data will be related to vegetation composition along a gradient of land degradation. Furthermore, the connection of field data with multispectral satellite images will provide large scale information about plant diversity. Our results will demonstrate possibilities of remote sensing techniques for heterogeneous mountain terrain. Potentially, the outcomes will confirm the application of remote sensing for an early detection of erosion risks and may offer potentials for the monitoring and management of diverse grassland that is in threat of erosion.

References

Nakhutsrishvili, G. et al. (2009): Main threats to mountain biodiversity in Georgia. Mountain Forum Bulletin (9/2): 18-19.

NBSAP (National Biodiversity Strategy and Action Plan - Georgia) (2005): Tbilisi. Available at: http://chm.moe.gov.ge/webmill/data/file/bsap_en.pdf (accessed: 15/05/13)

Schmidtlein, S. & J. Sassin (2004): Mapping of continuous floristic gradients in grasslands using hyperspectral imagery. Remote Sensing of Environment (92): 126-138.

Waldhardt, R. et al. (2011): Landschaftswandel im Kaukasus Georgiens. Spiegel der Forschung (28/2): 4-15. Giessen.

Contact

Martin Wiesmair MSc
Justus-Liebig-Univeristät Gießen
Center for international Development and Environmental Research (ZEU)
Senckenbergstr.3
35390 Giessen
GERMANY
martin.wiesmair@umwelt.uni-giessen.de
+49 (0)641/99-1278

Climate change, biodiversity and landscape planning in the Altai Mountains

S. Heiland, A.May, N.Kocheeva, M. Suhova, A. Minaev, A. Sitov, O. Juravleva
Technical University of Berlin, Germany; Gorno-Altais state University, Russia

Today climate change (CC) is recognized as one of the most serious and globally significant challenges to a society and ecosystems all over the world (Madrid Action Plan (2008-2013)). According to the Climate Doctrine (2009), a strategic target of a policy of the Russian Federation in the area of climate is a provision of a safe and sustainable development in the conditions of a changing climate and occurrence of corresponding threats; thus anticipatory adaptation to consequences of climate changes is considered to be a priority in a policy of climate issues.

At present landscape planning (LP) can serve as a concrete mechanism of implementing adaptation measures to climate change in the development plans of municipal entities. Thus it is important to find a balance between a natural and ecological value of mountain territories and existing kinds of wildlife management in the context of CC, considering vulnerability of certain components of social and ecological systems (livelihood and recreation, water and land use, current state of geographical landscapes, and biodiversity).

As a modelling site we chose the Kosh-Agach administrative district. The choice is caused by the characteristics of its geopolitical position and landscape and climatic differentiation.

The area under analysis is characterised by considerable dynamics of basic climatic indicators. For example, during the period of a tool supervision a stable increase in the mid-annual temperature (2.8 °C) with a gradient of 1.1 °C per 10 years has been indicated. The average seasonal temperature in winter of the last decade is above the norm by 4.3 °C, in summer - by 1.7 °C. However, with a considerable positive trend, there are fluctuations of various kinds in the seasonal temperature of air, and also there is a visible tendency to the increase in an average maximum of the temperature and decrease in an average minimum. It is mportant to notice that during the last years (2004-2009) an increase in intensity of summer precipitation (0.11 mm per day for 10 years of the summer period) has been observed.

Thus, for planning an ecologically focused land use of the Kosh-Agach district, initial climatic preconditions are the following:

- Increase in seasonal and annual temperatures of the ground air;
- Expansion of a range of extreme temperatures;
- Reduction of precipitation in the winter period;
- Dryness increase (aridity);
- Increase in intensity of summer precipitation;
- Reduction of number of days with a steady snow cover;
- Increase of late and early frosts.

The primary goal of an initial stage of LP was the assessment of reaction of the environment components to climate changes. To do so a point-based system has been developed for the purpose of an estimation of sensitivity of separate components to climate changes and a scale of importance of the identified reactions of components for the ecologically focused land use has been also developed. The gradation consisted of three points. The greatest value (3) means the preservation and improvement of functions of the given component. The minimum value was given to the sites on which the given component undergoes changes and reduces the quality of ecosystem services. While evaluating the meaningfulness, a maximum point corresponded to the improvement of the quality of environment for the economic branch purposes of land use. On the basis of the received results maps have been developed.

The evaluator, accepted in LP, has allowed to tackle the following areas: with the improvement of conditions of formation; with the absence of visible negative changes; with a risk of negative events; with a visible negative development; with the maximum speeds of development of exogenuous processes; and with various degrees of saltification. The specified differentiation has given the chance to divide problems into ecological, social, and economic on territorial level, which are caused by climate changes and to define an orientation of measures to the anticipatory adaptation.

Drawing up a map of conflicts was the next evaluation stage. There were revealed rather frictionless sites and the sites of existing and potential conflicts came to light.

In the studied area of the Kosh-Agach district we have identified five types of ecological areas (zones) – from a complete refusal of economic activities (PA) to the regulated intensive development with the greatest influence on a region environment. In between them there are types of ecological areas possessing the features of a category of a prohibitive and permissive character.

At the final stage the actions which allow to develop beforehand the administrative decisions allowing to adapt the existing system of land use to changing natural conditions were worked out.

Canadian method for peatland restoration: lessons learned for Germany?

Graf, M.D.; Rochefort, L.
Institute for Environmental Planning, Leibniz Universität Hannover, Germany; Département de phytologie, Université Laval, Québec City, Canada

During the last 20 years restoration measures have been developed in Canada to restore peatlands after horticultural peat extraction. These restoration measures include clearing any spontaneous vegetation, profiling and scraping off the biological crust, introducing vegetation from an undisturbed peatland in a 1:10 ratio, covering the vegetation with straw mulch, and finally fertilizing the peatlands with a light dose of phosphorus. Using these methods, an acrotelm with a cover of > 20% *Sphagnum* mosses can be achieved after two vegetation seasons. With time, the percentage of *Sphagnum* moss cover increases and with it, the restored sites begin to store carbon again. Are there aspects of this restoration technique which could be applied to restore industrial peatlands in Germany?

Climate change adaptation in a biosphere reserve: Trade-offs between nature conservation and other ecosystem services

Stefan Schörghuber, Werner Rammer, Manfred J. Lexer
Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Austria

A major goal of biosphere reserves is promoting solutions to reconcile the conservation of biodiversity with its sustainable use. Thus, biosphere reserves are crucial for demonstrating integrated management for ecosystem services and biodiversity.

For the biosphere reserve "Wienerwald" near the city of Vienna in Austria, the climate change vulnerability of different forest ecosystem services (timber production, carbon sequestration, recreation, game management) and nature conservation values (habitat for selected bird species, deadwood, species diversity) was identified, employing a comprehensive assessment approach including stakeholder participation. The study region (32,000 ha) was defined as the part of the biosphere reserve owned by the Austrian Federal Forests (ÖBf) and is covered by beech dominated mixed forests. For the assessment of future forest development the forest ecosystem model PICUS 1.4 (Seidl et al. 2005) was used. The model was run with detailed information about stand composition, site characteristics and the business as usual management. To identify climate change impacts a baseline climate as a reference and three transient climate change scenarios were used for the analysis. Based on the results of the vulnerability assessment under business as usual management, alternative adaptive management strategies were developed and analysed.

The results indicate that timber production is the most vulnerable ecosystem service. Nature conservation values show lower climate change vulnerability, but a high sensitivity to the forest management regime. Trying to address all demanded ecosystem services in an adaptive management concept exposes different trade-offs depending on the adaptation strategy. Intensified thinning regimes under adaptive management reduce the amount of standing deadwood (>20 cm diameter). The active promotion of standing deadwood via removing the bark of trees counteracts the effect. The habitat suitability of the White-backed Woodpecker is strongly influenced by the amount of standing deadwood. Enriching forest stands with drought tolerant trees species like oak leads to increased tree species diversity. Especially in cultivated landscapes, like the biosphere reserve "Wienerwald", future adaptive management will be crucial for sustainable provisioning of multiple forest ecosystem services and biodiversity under climate change.

References

Seidl, R.; Lexer, M.J.; Jäger, D.; Hönninger, K. (2005): Evaluating the accuracy and generality of a hybrid patch model. Tree Physiology. 25, 939-951.

Contact

Stefan Schörghuber
Institute of Silviculture, Department of Forest and Soil Sciences
University of Natural Resources and Life Sciences Vienna
Peter Jordan Straße 82
1190 Vienna City
Austria
stefan.schoerghuber@boku.ac.at
http://www.wabo.boku.ac.at/waldbau.html

Reed or salt grassland? Assessment of the ecosystem functions and services of coastal vegetation with respect to climate change and coastal protection at the German Baltic Sea

Koch Anastasia, Mantilla-Contreras Jasmin
Institute of Botany and Landscape Ecology, University of Greifswald, Germany; Ecology and Environmental Education Group, Institute of Biology and Chemistry, University of Hildesheim, Germany

The impacts of climate change on coastal habitats are well known. For coastal areas, most natural environments are endangered by increased coastal protection due to sea level rise and increased storm flood events. In addition, coastal ecosystems are directly affected by changes in water level and climate. At the German Baltic Sea, reeds are common in low lying areas and have been replaced in many areas by so called salt grasslands which have developed after age long grazing. Salt grasslands have a higher biodiversity as reeds and are therefore protected.

For the future the question rises if salt grasslands should be further maintained or if coastal management should prefer the natural vegetation of reeds. Both ecosystems fulfil several important ecosystem functions and services. However, salt grasslands need an extensive management which is, in most cases, cost intensive.

With a higher sea level it is important to know which habitat- reed or salt grassland- might better withstand climate change. If salt grasslands are not able to vertically grow as fast as reed communities with sea level rise, a management of those areas might not make sense at all.

We will discuss the ecosystem functions and services of both habitats and the management possibilities in response to climate change. We will further discuss which habitat might be more adapted to climate change. We will highlight the trade-offs between the two ecosystem types and what the main goals for future nature conservation will be in those areas.

References

Helsinki Commission (2007): “Climate Change in the Baltic Sea Area.” *Baltic Sea Environment Proceedings* No. 111.

Mantilla-Contreras, J.; Möller, I. and S. Zerbe (2010): “Einfluss von Klimaveränderungen auf Küstenhabitate der Ostsee.” *Naturschutz und Biologische Vielfalt*.

Contact

Koch Anastasia
Institute of Botany and Landscape Ecology, University of Greifswald
Grimmer Str. 88, 17489 Greifswald
koch.anastasia@web.de
http://www.uni-hildesheim.de/index.php?id=7066

Arctic coastal wetlands' resilience to climate change and human impact

Sergienko, L.; Minayeva, T.; Uspenskaya, O.; Zaretskaya, N.
Petrozavodsk State University; Wetlands International; Institute of Vegetable Crops Russian Academy of Agricultural Sciences; Geological Institute Russian Academy of Sciences, Russia

Arctic coastal ecosystems are vulnerable both to climate change and active industrial development. The "proactive ecosystem management" is one of many mitigation strategies in this case. This demands good background knowledge on ecosystem structural and functional characteristics. Hereby we suggest an integrated methodology for the baseline study of coastal wetlands to obtain this background knowledge on coastal ecosystems and use it for practical ecosystem management and to plan properly mitigation measures in space and time.

The integrated methodology provides the basic principles which can be developed into a method for each specific case. The coastal wetlands unite such ecosystem types as coastal tundras, salt and brackish marshes, ephemeral sandy ecosystems and ecotones from one to the other ecosystem type. They provide crucial ecosystem services having global significance: unique habitats including migrating birds and marine mammal species; carbon accumulation and storage; matter balance regulation including accumulation of contamination; maintenance of the landscape integrity. The current threats to coastal wetlands are ocean pollution from offshore activity (including shipping etc); enhancing access and infrastructure development; climate change reflected in sea level rise, high frequency of strong gales and storms and increase of ocean and soil temperature followed by thawing of the permafrost.

The methodology is based on the evaluation of the level of the ecosystems' sensitivity being defined through the capacity of the ecosystem to maintain its natural functions. Ecosystem functions are related to water balance, matter balance and biodiversity. The evaluation is based on the knowledge of the relations between the structural and functional components of ecosystems and identified from elementary characteristic such as: type of soil and subsoil; carbon content and accumulation rate including LORCA, long term (palaeo-) vegetation dynamics, groundwater level and quality; dependence on permafrost; relative position within the intertidal zone; effectiveness of habitat use by animal species.

Three levels of ecosystem organization are used to assess resilience: ecosystem, population and organism. This is reached by evaluating such parameters like: life form composition of plant communities; vegetation cover and species richness; coenopopulation structure; seasonal and perennial vegetation dynamics. Pressure factors are assessed both originating from natural and anthropogenic factors. Finally the results of the evaluation of the ecosystems' sensitivity along more than 20 criteria are summarized in a simple ranking matrix of the three groups of parameters and can be used as a decision making tool. The example of a matrix table is provided below.

Ecosystem type: / **Functions group:**	Low marsh	Middle marsh	High marsh	Hassyri	Tundra
Biodiversity	4	5	3	4	2
Matter balance	2	5	4	5	4
Water balance	1	4	2	1	5

The methodology based on the indicating of functions, translated to sensitivities opens perspectives for more precise planning of mitigation measures, including plans for mitigation, restoration, closure and compensation in space and time. This approach is the most effective one to be applied by land users aiming at introducing the no net loss principle in their corporative responsibility policy. The methodology was developed within a cooperation project between Wetlands International and Shell Arctic Theme; it is presently being tested in the framework of the GEF/UNDP project “Mainstreaming biodiversity conservation into Russia’s energy sector policies and operations”. We thank all staff of the Nenetsky Nature Reserve for their support in the field work and O. & I. Lavrinenko, M. Boychuk, M. Nosova for their advice and assistance for data processing.

Contact

Sergienko L.A.
Petrozavodsk State University
Lenina street 33
185910 Petrozavodsk
Karelia
Russian Federation
muddycoast@gmail.com
http://www.petrsu.ru/Faculties/biology.html

Mind the summit trap? Cold stenothermic fauna in headwaters and its climate change monitoring potential

Martin Reiss & Stefan Zaenker
Philipps-Universität Marburg, Fachbereich Geographie; *Landesverband für Höhlen- und Karstforschung Hessen e.V., Germany*

An assessment of the cold stenothermic freshwater in headwater streams of the Rhön Mountains as an example of the low mountain ranges in Germany is presented. The study analysed a data set from the Biospeleological Register of Hesse (BRH) maintained by the Hesse Federation for Cave and Karst Research (Reiss et al. 2009). The BRH is a data archive for flora, fauna and data relating to the environmental characteristics of subterranean habitats (headwater springs are also included) in the State of Hesse, Germany. We investigated 1,916 spring plots in the Rhön Mountains and their faunistic inventory, however, it is mostly a single recording of crenal habitats. Nevertheless, the study area is a very good showcase example with an excellent overview of the distribution of cold stenothermic fauna.

Cold-adapted species are stressed by climate warming, and more importantly, must compete with species from lower elevations extending their ranges upward. On mountains, increasing temperatures force those species to migrate upwards until they reach the highest elevations (summit trap phenomenon; Pertoldi & Bach 2007). They have no escape route and may become locally extinct. Our first question is: Do we have to expect such conditions in the Rhön Mountains in fauna communities in headwaters for the future? Therefore, we analysed own empirical sampled data with the following key findings:

- Altitude Range all springs: Mean 616m (25-Q: 505m; 75-Q: 727m)
- Most cold stenothermic taxa are above the mean value
- The endemic Spring Snail *Bythinella compressa* shows a distribution with the highest altitude (Mean: 660m; 25-Q: 605m; 75-Q: 740m) → Endangerment see Reiss et al. (2013)
- Cold stenothermic taxa cumulate between >600 and 800 m.a.s.l.
- Cold stenothermic taxa often reach the mountain top areas
- Cold stenothermic taxa are recently close to their summit trap
- The summit trap phenomena is species related heterogeneous

Future research needs:

- Long term climate change monitoring plots in spring / headwaters (e.g. in the Core Zones of the Rhön Biosphere Reserve)
- A long term monitoring program under different land use conditions within the plots
- Studying and analysing of the distribution ecology of related taxa
- Action & Management Plans for nature conservation

References

Pertoldi, C. & L.A. Bach (2007): Evolutionary aspects of climate-induced changes and the need for multidisciplinarity. In: Journal of Thermal Biology 32, 118–124

Reiss, M.; Steiner, H. & S. Zaenker (2013): Gefährdungssituation der endemischen Rhön-Quellschnecke (*Bythinella compressa*), der Begleitfauna und des Lebensraums in Hessen. In: Feit, U. & H. Korn (Hrsg.): Treffpunkt Biologische Vielfalt XII. Interdisziplinärer Forschungsaustausch im Rahmen des Übereinkommens über die biologische Vielfalt. Bonn, BfN-Skripten 335, 53-57.

Reiss, M.; Steiner, H. & S. Zaenker (2009): The Biospeleological Register of the Hesse Federation for Cave and Karst Research (Germany). Cave and Karst Science 35(1), 25-34

Contact

Dr. Martin Reiss
Philipps-Universität Marburg (University of Marburg)
Deutschhausstr. 10
D-35037 Marburg
Germany
reissm@geo.uni-marburg.de
http://www.uni-marburg.de/fb19/personal/wiss_ma/reiss/

High elevated peatlands in Mongolia – most vunerable grasslands under climate change in central Asia

Sirin, A.; Minayeva, T.; Gunin, P.; Dugardjav, Ch.; Bazha, S.; Bayasgalan, D.; Dorofeyuk, N.; Uspenskaya, O.
Institute of Forest Science, Russian Academy of Sciences; Wetlands International; Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences; Botanical Institute, Mongolian Academy of Sciences; Institute of Vegetable Crops, Russian Academy of Agricultural Sciences

Cattle breading is traditionally a key economic sector in Mongolia and grasslands are the most important lands there. The livestock population strongly increased during last 20 years. There is strong evidence of climate driven desertification during the last decades in the region and traditional pastures are losing their productivity. Increased stock is pushed to wetter locations often covered by organic soils. We found that peatlands cover over 1.7% of the country and field studies showed their dramatical changes. Being under more favorable climatic conditions in the past they are degrading progressively during the last decades. Peatlands are much more vulnerable to over-pasturing than grasslands on mineral soils. Recognising the peatlands' specific origin and their wise use could serve as a key measure for their adaptation to climate change, to combat desertification and grassland degradation in the region.

Contact

Sirin A.
Institute of Forest Science Russian Academy of Sciences
Sovetskaya 21
Uspenskoye
Moscow Region
143030, Russia
+7 495 6345257
sirin@ilan.ras.ru

Collective action and seed isles in common rangelands as a joint climate adaptation strategy

Stefanie Christmann, Aden Aw-Hassan, Toshpulot Rajabov
Environmental Governance, ICARDA, SEPRP, ICARDA-Headquarter, Samarkand State University, Uzbekistan

Rangeland degradation is a global problem, in Europe for instance around the Mediterranean. Climate change fuels loss of biodiversity and trend to desertification. In Uzbekistan a pilot project demonstrated success in overcoming fatalistic acquiescence in the tragedy of the commons. Based on participatory development of local climate change scenarios, through a social learning process, villagers identified adaptation options and developed a common purpose to restore rangelands through collective governance systems with enforcement of rules. They formed pastoral user groups, established scattered seed isles partly with iron railings partly fenced by social agreement to ensure seeding of forage shrubs and agreed on seasonal grazing. This case study shows the critical importance of social learning processes for climate change adaptation in inducing unrestrained debate among users, change of perceptions and development of an integrated approach. This approach yields successful climate change adaptation through strengthened local institutions, safeguarded seeding process and environmental governance.

References

Christmann, S.; Aw-Hassan, A.; Rajabov, T. and A. Rabbimov *(forthcoming, probably in 2013)*: Collective action for common rangelands improvement: A climate adaptation strategy in the Central Asian dry lands.

Tompkins, E.L. and W.N. Adger (2004): Does adaptive management of natural resources enhance resilience to climate change? Ecology and Society 9(2).

Reed, M.S.; Evely, A.C.; Cundill, G.; Fazey, I.; Glass, J.; Laing, A.; Newig, J.; Parrish, B.; Prell, C.; Raymond, C. and L.C. Stringer (2010): What is Social Learning? Ecology and Society 15(4).

Ngaido, T. and N. McCarthy (2004): Collective Action and Property Rights for sustainable development. Institutional Options for Managing Rangelands. CAPRI Focus 11, Brief 9, February 2004. http://ageconsearch.umn.edu/bitstream/16575/1/fo041109.pdf (accessed 6 August 2012)

Contact:

Dr. Stefanie Christmann
ICARDA
P.O. Box 4564
Tashkent 100 000
Uzbekistan
s.christmann@cgiar.org
www.icarda.org

Planning instruments towards Urban Biosphere

Benedetto Nastasi
DPDTA Department of Planning, Design, Technology of Architecture, Sapienza University of Rome, Italy

In European cities, the increasing environmental and economic cost of unsustainable cities planning, during the last years, allowed us to obtain a major environmental awareness and to shift the focus on alternative use of urban environment to cope climate change. According to the provisions of the European Road Map 2050, 80% of the world's population will live in cities. Today, urbanisation is a unique driver of building community, but it is also cause of biodiversity loss. The urban-rural interface is the changing boundary of this phenomenon. Urban planning, also to preserve biodiversity, has only recently adopted Sustainable Energy Action Plans (SEAP), but taking into consideration clearly separated from urban ecosystems and agricultural lands. For this reason the author of this study realised a critical review, based on the state of the art in the field of SEAP, with specific regards to the relationship with the urban green spaces and their role in the connectivity of different ecosystems. This has been considered achievable just through an urban planning proved to be deeply tied to the particular biodiversity of the involved area, towards the creation of an Urban Biosphere. The case study is Rome, the largest European agricultural community, extended to 128,000 ha. By relating the city-wide green spaces mapping to the land use of Rome, the author highlights bioenergy and sustainable food production potential, not threatening biodiversity. Green spaces cover 71% of Rome’s surface, or 92,000 ha, and 57% of this area is devoted to agriculture. Rome, by an environmental policy called the Ecological Network, was equipped with the instruments for the unbuilt land protection. This protection provides the ability to environmental regeneration cycles for air and water quality. It needs further energy policy to support agriculture, to protect and strengthen the peculiarities of the different biotic and cultivars. According to the author, the construction of an urban biosphere is intervening in urban processes with 3 principles, aimed at the welfare of the ecosystem and therefore of man, as a citizen. The result of this study is carried out through the efficiency evaluation of agricultural production cycles and urban green spaces maintenance, obtaining clean renewable energy estimated at 125,000 MWh/y and CO_2 sequestration estimated at 40,000 ton/y.

References

De Santoli, L.; Nastasi, B. (2012): Biomasse, reti energetiche e sistema rurale. SLOWFOOD, vol. 54, p. 86-88, ISSN: 1825-876X

De Santoli, L.; Nastasi, B. (2013): Modello energetico e agricoltura. NUTRIRSI, vol. 13, p. 63-66, ISSN: 2240-7537

Fischer, L.K.; Von der Lippe, M.; Kowarik, I. (2013): Urban land use types contribute to grassland conservation: The example of Berlin. URBAN FORESTRY & URBAN GREENING *in press* ISSN: 1618-8667

Nastasi, B. (2013): Ruralità urbana nei quartieri ERP: processi agricoli di partecipazione. In Lambertini, Metta, Olivetti. CITTÀ PUBBLICA/PAESAGGIO COMUNI. p. 174-176, ISBN: 978-88-492-2674-4

Contact

Benedetto Nastasi
DPDTA Department of Planning, Design, Technology of Architecture, Sapienza University of Rome
Via Flaminia 72
Rome, 00196 Italy
benedetto.nastasi@uniroma1.it
http://w3.uniroma1.it/data

Effects of extreme meteorological conditions on reproductive success in a temperate-breeding songbird

Ivett Pipoly, Veronika Bókony, Gábor Seress, Krisztián Szabó, András Liker
Department of Limnology, University of Pannonia; Department of Ecology, Szent István University, Hungary

The frequency of extreme meteorological events such as heat waves and rainstorms is predicted to increase with climate change. However, there is still little information about how extreme weather influences reproduction in animals. It may not only affect breeding success but might also alter offspring sex ratio if males and females are differentially sensitive to meteorological conditions during development.

We investigated the relationship between meteorological conditions and reproductive success over 6 years in a house sparrow population in central Europe. We found that hatching success increased with the number of extremely hot days and decreased with the number of extremely cold days during incubation, although the latter effect held only for clutches with relatively short incubation periods. Fledging success was unrelated to weather variables. However, the frequency of extremely hot days had a negative effect on fledglings' body mass and tarsus length, although both of these traits were positively related to average temperature. Additionally, fledglings' body mass increased with the length of period without rainfall before fledging. Male to female ratio among fledglings did not differ from 1:1 and did not vary with weather variables. The magnitude of the effects of extreme meteorological events was usually small, although in some cases comparable to those of ecologically relevant predictors of reproductive success.

Our results indicate that meteorological conditions have complex effects on breeding success, as the effects of extreme weather can differ between different aspects of reproduction and also from the effects of overall meteorological conditions.

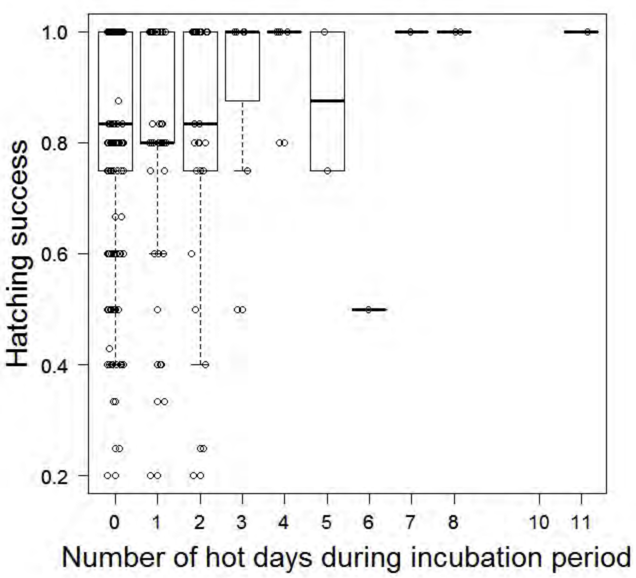


Figure 1: **Relationship of hatching success with the number of hot days during incubation.** Box plots show the median (thick line), interquartile range (box) and the range of data (whiskers); sample sizes are shown below each box.

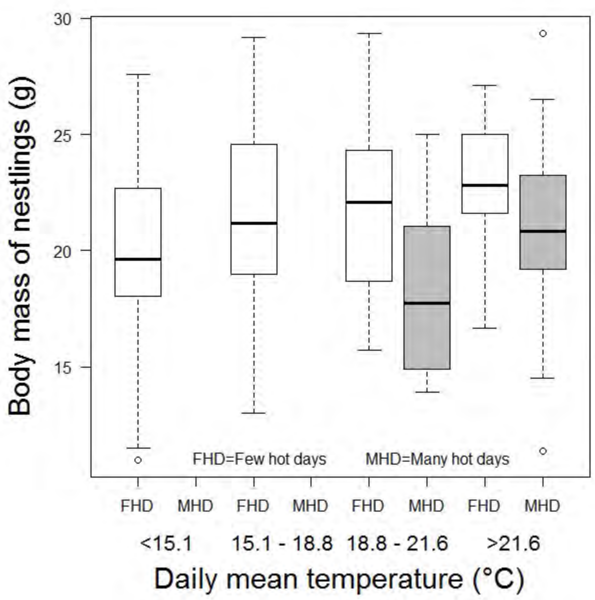


Figure 2: **Relationship of nestlings' body mass with average daily mean temperature and number of hot days.** For illustrative purposes, daily mean temperature was categorized according to its 25%, 50% and 75% percentiles. The number of hot days was dichotomized as few (≤2; white boxes) and many (>2; grey boxes) as the median was zero and the 75% percentile was 2 hot days. Body mass was controlled for date and age of nestlings. Box plots show the median (thick line), interquartile range (box) and the range of data (whiskers).

Contact

Ivett Pipoly
Department of Limnology, University of Pannonia
Egyetem utca 10, Pf. 158
H-8201 Veszprém
Hungary
pipoly.ivett@gmail.com
http://ornithology.limnologia.hu/people/ivett-pipoly/

Planning for change – How to adapt protected area management

CHRISTIAN WILKE, SVEN RANNOW
Technische Universität Berlin; Leibniz Institute of Ecological Urban and Regional Development, Germany

Large protected areas like national parks or biosphere reserves need to adapt their management to climate change and its impacts. The EU INTERREG Project HABIT-CHANGE developed a framework to integrate climate change related information into protected area management to derive adaptation strategies and measures. The approach was tested and applied in cooperation between researchers and protected area managers. It helps to initiate the adaptation process to climate change and enables protected area managers to

- involve relevant stakeholders and land users to build awareness and acceptance,
- assess the impacts of climate change on natural resources, and
- introduce and implement the concept of "Adaptive Management" that structures the management as a learning process.

A transparent (planning) process of adapting conservation management with extensive stakeholder involvement is as important as the assessment of potential impacts of climate change on natural resources. Main objective of the adaptation process should be to answer the question: How can protected area management respond to climate change and its impacts on natural resources?

The result of the adaptation process is a climate change adapted management plan that contains all information necessary to manage protected areas under changing climatic conditions. It is designed to help enhancing today's management with regard to the best available knowledge about climate change and its impacts on protected areas. Suggested work steps for the adaptation process are:

1. Development of a **concept for stakeholder involvement**, communication and participation
2. Definition of **objectives and scope** of the adaptation process
3. Building of a **conceptual model** to illustrate all relevant pressures and drivers
4. **Data collection** and inventory of available data
5. **Assessment** of climate change and its impacts on biodiversity
6. Development of **monitoring concept**
7. Definition of **adapted management strategies** and measures

The consideration of stakeholder interests and concerns is regarded as a (pre)condition for effective management under climate change. Stakeholder involvement is a basic element of "Adaptive Management", too. It helps to overcome some of the obstacles we identified during the adaptation process. Such as: missing or outdated data on natural resources and management effectiveness; lack of awareness for climate change impacts and support for the adaptation process; uncertainties related to modelling results on climate change and its impacts; low capacity (resources, manpower, expertise) in the protected areas.

References

For detailed guidance for adaptation planning and results from HABIT-CHANGE please visit: www.habit-change.eu

Contact

Dr. Christian Wilke
Technische Universität Berlin, Sekr. EB 5
Straße des 17. Juni 145
10823 Berlin, Germany
Christian.Wilke@tu-berlin.de,
http://www.landschaft.tu-berlin.de/

Dr. Sven Rannow
Leibniz Institute of Ecological Urban and Regional Development
Weberplatz 1
01217 Dresden, Germany
s.rannow@ioer.de
www.ioer.de

Present and historical climate variability in South West England

Sasha Kosanic, Stephan Harrison and Karen Anderson

West Cornwall is the most south westerly part of the United Kingdom with a strong maritime climate. This paper analyses the earliest archived instrumental meteorological records collected in West Cornwall (SW England). Observations were obtained from the Met Office archive (Camborne 1957-2010; Culdrose 1985-2011), Trengwainton Garden (1940-2010), and from the Royal Cornwall Polytechnic Society, data for Falmouth (1880-1952) and Helston (1843-1888). Homogeneity tests were used (Levene and Brown-Forsythe tests) to exclude any trends not related to climate variability. The data exhibit trends in annual mean and maximum temperatures over the timescales analysed, and show a general temperature increase in the 20th and 21st century. Annual and seasonal temperature change was found to vary locally with strongly positive trends in autumn, spring and summer seasons. Trends in precipitation are positive for the 19th century only and only for one station. Correlation with North Atlantic Oscillation (NAO) index gives negative results for precipitation data. However correlation with NAO index is positive with temperature, especially in the winter season. Return period analysis shows a decrease in intensity and frequency of extreme precipitation events in the post-1975 period (Camborne and Trengwainton Garden stations). Climate change in the 20th century and future continued warming is likely to have major implications on biodiversity in this region. The second part of this research will track changes in the geographical distribution of plant species over West Cornwall using Ellenberg values, and herbarium and current vegetation records. This research will clearly contribute to better identification of the climate change impact in West Cornwall, but will also benefit policy developing strategies to identify areas at risk on climate impacts at the regional and national scale.

Contact

Sasha Kosanic
ak352@exeter.ac.uk

Engaging conservation managers towards effective adaptation

Simon Duffield, Mike Morecroft, Andy Neale and Olly Watts
Natural England; RSPB; UK

Appropriate adaptation will be subject, place and context specific, with the priority responses in one area differing from another. Natural England and the RSPB are developing a practical toolkit which engages and guides conservation managers to consistent adaptation responses and provides practical adaptation information for a wide range of habitats.

The decision support framework takes land managers and advisors through the important questions of adaptation. This builds from core approaches of biodiversity adaptation strategies – resilience and accommodation to change, and potentially to transformation of ecosystems. Assessing vulnerability through exposure, sensitivity and adaptive capacity leads to re-considering objectives and identifying appropriate adaptation pathways and spatial scale.

Practical habitat adaptation information for key conservation habitats provides core information for site managers. Web based and flexible, more habitats will be added and can be expanded in collaboration with other organisations, to provide an authoritative resource for a wide range of conservation activities.

Contact

Olly Watts
RSPB
The Lodge
Sandy
Bedfordshire
SG19 2NF, UK
olly.watts@rspb.org.uk
+44 (0) 1767 69 3084

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

KATRIN VOHLAND, STEFAN KREFT, FRANZ-W. BADECK, KATRIN BÖHNING-GAESE, WOLFGANG CRAMER, JAN HANSPACH, PIERRE L. IBISCH, STEFAN KLOTZ, INGOLF KÜHN & SVEN TRAUTMANN

Potsdam Institute for Climate Impact Research; Natural History Museum, Leibniz Institute for Evolutionary and Biodiversity Research at the Humboldt University Berlin (MfN); Centre for Econics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development; Johannes Gutenberg University, Institute of Zoology; Biodiversity and Climate Research Centre; Leuphana University Lüneburg, Institute of Ecology; Helmholtz Centre for Environmental Research – UFZ, Department of Community Ecology

Climate change is impacting biodiversity directly, e.g. by changing the phenology and distribution area of plants and animals. More indirect effects concern biome shifts. Climate change is also leading to the decoupling of ecological processes.

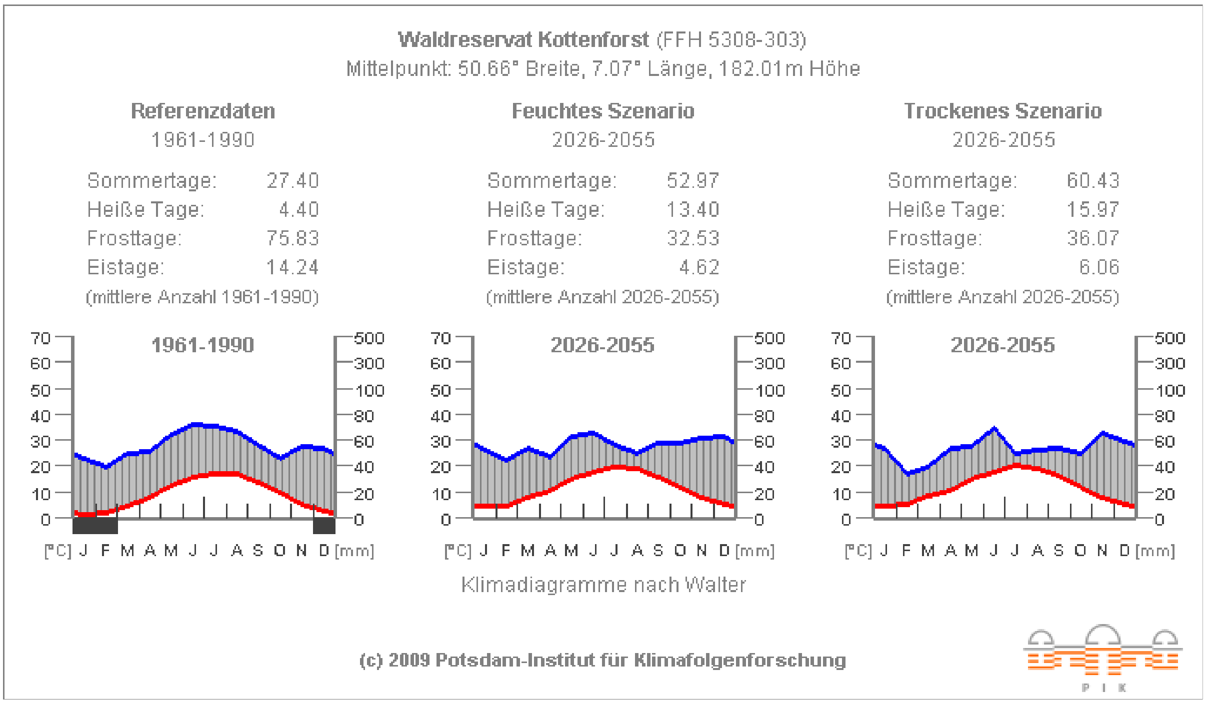


Figure 1: For more than 4000 Natura 2000 sites of Germany climate change scenarios were projected enabling discussions of the consequences of climate change for the respective sites. Here, typical climate parameters as well as Walther diagrams are shown for a selected site. More information is found under http://www.pik-potsdam.de/services/infothek/klimawandel-und-schutzgebiete.

Natura 2000 aims at reducing the loss of biodiversity in Europe. The Birds and Habitats Directives target annex species and life communities. For some species of the annexes there is the risk to be driven out of their current German ranges by climate change. Establishment within a future climatic envelope might be hampered by unsuitable abiotic and biotic conditions, such as inappropriate land use and soil conditions. Water has a central role; the climatic water balance is projected to decrease especially in summer in most sites.

Life communities that harbour cold-adapted species with small ranges are especially endangered. 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 (*Picea abies*) 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 protected area system in terms of management categories as well as spatial and ecoregional settings.

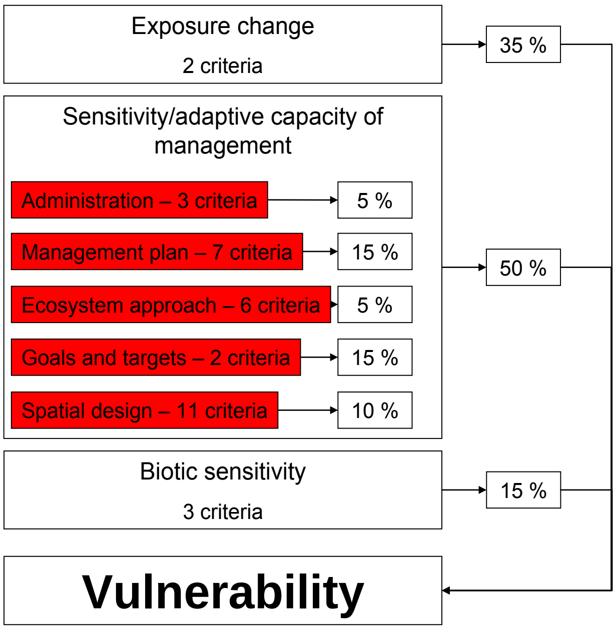


Figure 2: Criteria groups for the assessment of the vulnerability of protected areas against climate change. The criteria groups are aggregated into four blocks that incorporate the common trias of factors contributing to the vulnerability of systems, i.e., exposure change, sensitivity and adaptive capacity. Management is arbitrarily set to determine 50 % of the vulnerability. Similarly, the relative weight of the criteria groups was defined based on educated guesses 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 brand new comprehensive book publication (in German) is now available:

Vohland, Katrin, Franz Badeck, Katrin Böhning-Gaese, Götz Ellwanger, Jan Hanspach, Pierre L. Ibisch, Stefan Klotz, Stefan Kreft, Ingolf Kühn, Eckhard Schröder, Sven Trautmann & Wolfgang Cramer (eds., 2013): Germany’s protected areas under climate change - risks and policy options. Naturschutz und Biologische Vielfalt 129. 240 pp.

Further information:

Project homepage: http://www.pik-potsdam.de/services/infothek/klimawandel-und-schutzgebiete

Contact

Stefan Kreft
Centre for Econics and Ecosystem Management, Faculty of Forest and Environment,
Eberswalde University for Sustainable Development (Univ. of Appl. Sc.)
Alfred-Moeller-Str. 1
D-16225 Eberswalde
Germany

Implementation of innovative management techniques by operators of high-voltage networks: “Creating green corridors under overhead lines” (LIFE+ Biodiversity)

Jean-Francois Godeau
LIFE ELIA

The protection of species and their habitats is the most common solution proposed to limit the erosion of biodiversity. The use of strong protection status of natural areas depends either on the willingness of authorities (and public money) or on involvement of volunteers. On the other hand, facilities such as electric lines, pipelines, motorways, etc. form a wide network of habitats that have to be managed regardless of their natural or economic value. These areas shelter or might shelter biodiversity if properly managed, increasing the amount of 'nature-friendly' areas as well as ecological corridors between natural sanctuaries. Such a network of ecological corridors can help species to migrate across the landscape matrix to face effects of climate change.

Elia (in Belgium) and RTE (in France) are leading a LIFE+ project that aims to implement in their daily activities new management techniques that transform unused areas into highly valuable habitats as new gene pools or stepping stone habitats for endangered species. The challenge of adapting human activities to the loss of biological diversity and to the effects of climate change without additional costs is the goal of our project. The results planned for the end of the LIFE project (August 2016) consist in concrete actions in the field (restoration of natural forest edges and threatened habitats, creation of ponds and local varieties orchards, limitation of invasive plant species, etc.) as well as management guidelines and training intended for operators in other countries.

Biodiversity of decapod crustaceans in the Southern North Sea changes in space and time

MICHAEL TÜRKAY & MORITZ SONNEWALD
Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Germany

Beam trawl samples were taken at several occasions between the years 1986 and 2007 in the German sector of the North Sea continental shelf, in order to collect and study the composition of the epibenthic mega- and macrofauna. The main target was to identify the changes over time and correlate these with possible causes.

Findings of some decapod species considered to be thermophilic are presented. Two of them are *Goneplax rhomboides* and *Liocarcinus marmoreus*, which we first detected in 2007. Nevertheless, we know from colleagues and literature sources (e.g. Neumann et al. 2010) that they seem to be present in the research area since the beginning of the 21st century, going along with an increase of the mean water temperatures.

This trend of faunal changes and new records showing up in recent years can be confirmed by several of our Dogger Bank studies (Sonnewald & Türkay 2011, 2012a, 2012b, Sonnewald & Janssen 2012). Also, a cluster analysis of the species composition of decapod crustaceans at the 43 sample sites is presented, in order to demonstrate the relation between distinct geographic regions and the associated decapod species composition, which appears to be dependent on – and changing with depth and sediment types. A positive correspondence with the findings of Salzwedel et al. (1985) on the endofauna is obvious.

In order to successfully correlate species composition with environmental (temperature/current) parameters, the 2007 cruise will be repeated at the end of July 2013. With these new data, it will be possible to identify changes over time and to present the extended results of this study.

References

Neumann, H.; Ehrich, S. & I. Kröncke (2010): Establishment of the angular crab Goneplax rhomboides (Linnaeus, 1758) (Crustacea, Decapoda, Brachyura) in the southern North Sea. Aquatic Invasions 5, 27–30.

Salzwedel, H.; Rachor, E. & D. Gerdes (1985): Benthic macrofauna communities in the German Bight. Veröff. Inst. Meeresforsch. Bremerh, 20(2), 199-267.

Sonnewald; M. & M. Türkay (2011): The megaepifauna of the Dogger Bank (North Sea): species composition and faunal characteristics 1991–2008. Helgoland Marine Research 66, 63–75.

Sonnewald, M. & M. Türkay (2012a): Environmental influence on the bottom and near-bottom megafauna communities of the Dogger Bank: a long-term survey. Helgoland Marine Research 66, 503–511.

Sonnewald, M. & M. Türkay (2012b): Abundance analyses of mega-epibenthic species on the Dogger Bank (North Sea): Diurnal rhythms and short-term effects caused by repeated trawling, observed at a permanent station. Journal of Sea Research 73, 1–6.

Sonnewald, M. & R. Janssen (2012): Recent spreading of Xandarovula patula (Mollusca: Gastropoda: Ovulidae) towards the central North Sea suggests a link to rising water temperatures. Marine Biodiversity Records 5, 1–5.

Contact

Moritz Sonnewald
Senckenberg Forschungsinstitut und Naturmuseum Frankfurt
Senckenberganlage 25
60325 Frankfurt a. M.
michael.tuerkay@senckenberg.de, moritz.sonnewald@senckenberg.de

Future-proofing the Somerset Levels: A need for information and innovation

MARK STEER, FRANCESCA TREMLETT, STEPHEN DURY & DAVID LEACH
Somerset Wildlife Trust; University of the West of England; Somerset County Council, UK

The Brue Valley is a lowland peat wetland covering 12,500 hectares of the Somerset Levels and Moors. Its habitat type today is largely determined by an interaction between water levels and management. It is a highly managed system where local human responses to changing environmental, economic and social factors have played a key role in shaping the landscape. The site supports internationally important wetland habitats and populations of breeding waders, overwintering waterfowl and aquatic invertebrates, as well as being of international importance for archaeology and a landscape of national significance.

In such highly managed wetland landscapes, land-use changes arise from complex interactions between environmental and socio-economic variation. It is important for ecologists and conservationists to understand possible futures and work with local communities to shape a landscape which will be resilient, economically sustainable and rich in biodiversity in the long term. However, persuading a variety of land-user groups to co-operate and adapt is a challenge, especially when the future is uncertain. In this study predictions of climate change were integrated with different social and economic scenarios to produce ‘storyline’ narratives that can be shared with local communities to instigate dialogue and inform local and nature conservation planning.

An ecosystem services approach was adopted to enable the wide variety of values and priorities placed on the land to be combined in a cohesive baseline description. GIS was used to map land use features against services and sensitivity thresholds to derive likely area and service changes arising from climate and/or socio-economic changes. Data constraints often restricted the study findings to generic category and qualitative evaluations. However, distinct patterns in the results enabled the identification of wetland features and services at regular high risk, and of adaptations that offered consistently ‘good value’ across a wide range of future scenarios. The study found that most features of this lowland wetland temperate landscape were sensitive to water-table changes but that projected changes in temperature in the Brue Valley were unlikely to exceed feature tolerance levels. However, qualitative effects were common, in particular deriving from changes in productivity allied to longer growing seasons, and will require adaptive management in order to maintain environmental quality. Some effects, such as phenological miscues, pose a significant risk for biodiversity such as breeding waders for which a technological ‘fix’ may prove elusive.

Practitioners in highly managed landscapes require adaptation strategies that make the most of the data and techniques available, but which also take account of and describe uncertainties in a way that can be understood by a wide range of user groups. The study found the ecosystem services approach helpful to describing the site according to a wide range of different ‘values’, and in illustrating how services such as biodiversity, food production, water regulation and greenhouse-gas balance changed with climate change and socio-economic variation, with frequent trade-offs between services.

Contact

Steve Dury
Somerset County Council
42 Upper High St
Taunton TA1 3PY
UK
SDury@somerset.gov.uk
http://www.somerset.gov.uk

High resistance of Eastern Mediterranean vegetation to climate change in a long-term experimental and theoretical study

Johannes Metz, Wolfgang Siewert, Mark Bilton, Sara Tomiolo, Katja Tielbörger

Tübingen University, Department of Plant Ecology, Institute for Evolution and Ecology, Germany

The Eastern Mediterranean region is expected to face a steep decrease in rainfall and rising temperatures, with consequent high vulnerability for semi-arid ecosystems (Smiatek et al. 2011). We present results of long term monitoring of community composition and population demography along a steep rainfall gradient in Israel ranging from mesic-Mediterranean to arid conditions. In the two central sites, characterized respectively by Mediterranean and semi-arid climate, rainfall manipulations were applied consisting of three treatments: control, dry and wet (-30% and +30% precipitation respectively). Community composition was analysed to evaluate potential changes in species richness in response to climate (Tielbörger *et al*. unpublished). In addition, deterministic population growth rate (λ_s) was calculated for different species under climate change scenarios (current *vs*. predicted) (Salguero-Gomez et al. 2012).

Species richness varied among sites and years but generally not significantly among treatments (Figure 1a), and values of λ_s showed a decline in population growth under predicted climate scenarios (Figure 1b). In conclusion, community composition might buffer stochasticity of dry years (Salguero-Gomez et al. 2012), whereas population growth rate will experience a decline especially in the case of semi-arid species (Munson et al. 2011).

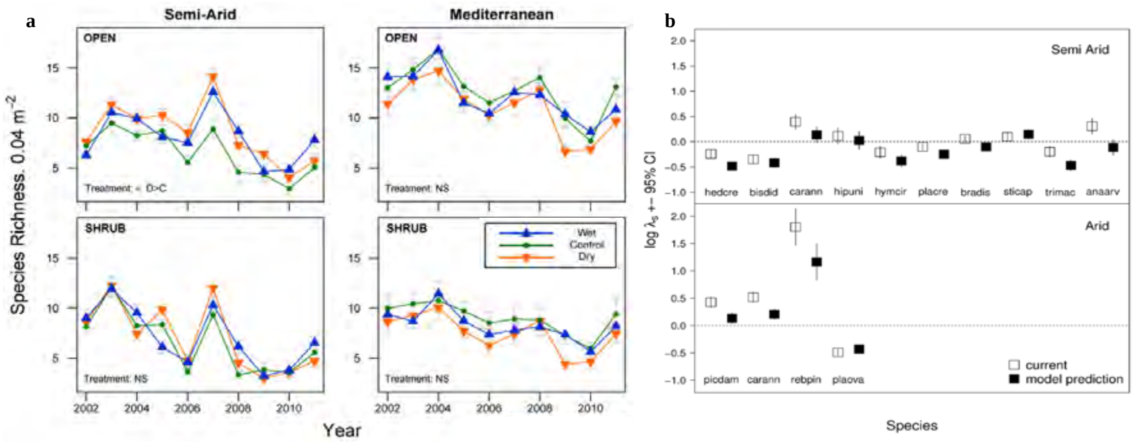


Figure 1: a) Species richness in different rainfall treatments, calculated in different microhabitat across years, b) deterministic population growth rate (λ_s) calculated for different species from semi-arid and arid sites under current and predicted climate scenarios

References

Smiatek, G.; Kunstmann, H. and A. Heckl (2011): High-resolution climate change simulations for the Jordan River area. Journal of Geophysical Research-Atmospheres, 116.

Salguero-Gomez, R. et al.(2012): A demographic approach to study effects of climate change in desert plants. Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 367(1606): p. 3100-14.

Munson, S.M.; Webb, R.H. and J.A. Hubbard (2011): A comparison of methods to assess long-term changes in Sonoran Desert vegetation. Journal of Arid Environments, 75(11): p. 1228-1231.

Contact

Sara Tomiolo
Tübingen University – Institute for Evolution and Ecology – Plant Ecology Group
Auf der Morgenstelle 3
D-72076 Tübingen
Germany
sara.tomiolo@uni-tuebingen.de

Simulation of natural reforestation after windthrow – subproject of the "Virtual Forest NRW"

SILVANA SIEHOFF, TIDO STRAUSS, GOTTFRIED LENNARTZ
Research Institute for Ecosystem Analysis and Assessment (gaiac), RWTH Aachen University, Germany

The "Virtual Forest" is a joint project (co-financed by the EU and NRW, Ziel 2, ERDF: European Regional Development Fund) of forestry and ecology in North Rhine-Westphalia (NRW), in which real forest stands are modeled as virtual ecosystems and production sites and which serves as an innovative source of information and aid for the forestry. Since extreme storm events have been increasing lately, the question of how natural regeneration processes can be integrated into conventional forestry practices gains in importance. What is more, the restoration of forest biotopes with a natural biodiversity is a main goal of nature conservation. Natural reforestation is strongly site-specific and in order to provide a projection for a specific site, we adapted the dynamic, mechanistic GraS (Grassland Succession) Model, creating the WoodS (Woodland Succession) Model. Early succession (20 years) after windthrow is modeled using difference equations of the herb layer and an individual-based model (IBM) for trees. Both submodels work and interact in a spatially explicit, raster-based landscape (cell size 1 to 2 m, up to 75 ha, figure 1). Input data for the model consists of specific site conditions, the surrounding vegetation, forest history and the abundance of browsing ungulates.

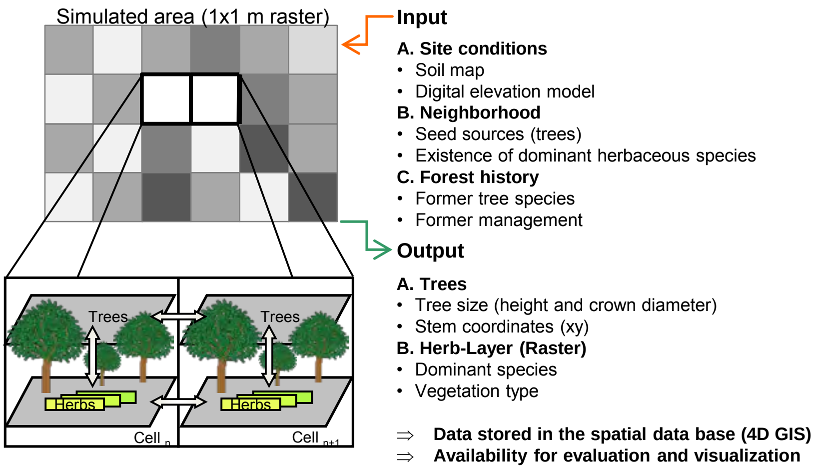


Figure 1: Model concept: Individually modeled trees are embedded in a grid-based difference equation model for the herbaceous vegetation. All stated processes may take place in all cells. Arrows represent interactions: trees ↔ trees and grasses ↔ grasses: competition for space; trees ↔ grasses: grasses inhibit seedling establishment, whereas growing trees provide shade and push away grasses.

Model output consists of a raster map including the dominant herbaceous species in each cell. The individually simulated trees are given with their size, age, and the x/y-coordinate of the tree stem. The simulation results are stored in a spatial data base and 3D-visualised.

Data for model development was obtained using conventional monitoring and remote sensing techniques. In NRW, 500 ha of windthrows (the CBD-Sites) have not been actively reforested after the hurricane Kyrill in 2007, but have been left to natural succession. Six of these sites have been intensively monitored (Figure 2).

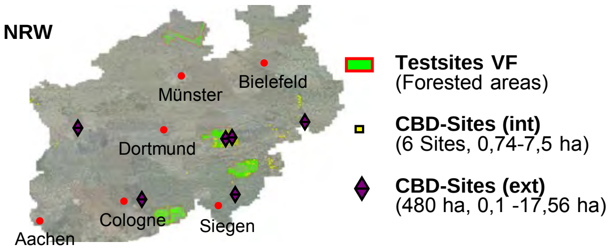


Figure 2: North-Rhine Westphalia (NRW) with the test sites of the Virtual Forest (VF) and the CBD-sites, which have been left to natural succession after the hurricane Kyrill in the year 2007 (ext. int.: extensively/intensively monitored).

The objective of this project is the simulation of the site-specific, natural regeneration of windthrow areas. The goal is to gain further understanding of how natural regeneration processes can be integrated in conventional forestry practices considering biodiversity. The project is still ongoing and will be finished 2014. First simulation results and visualization will be available soon.

References

Lennartz, G.; Leder, B.; Schmitz, K-H.; Siehoff, S. (2012): Natürliche Entwicklung von Windwurfflächen in NRW – dynamische und gebietsspezifische Prognosen. Natur in NRW 4/12, p. 22-24.

Siehoff, S. (2011): Succession of Semi-Natural Grasslands: Spatially-Explicit, Mechanistic Simulation Considering Various Forms of Land Use. PhD-Thesis, RWTH Aachen University, Aachen. http://darwin.bth.rwth-aachen.de/opus3/frontdoor.php?source_opus=3853&la=de

Siehoff, S.; Lennartz, G.; Heilburg, I.; Roß-Nickoll, M.; Ratte, H.T.; Preuss, T.G. (2011): Process-based modeling of grassland dynamics built on ecological indicator values. Ecological Modelling, 222, p. 3854-3868.

Lennartz, G.; Siehoff, S.; Ross-Nickoll, M.; Preuss, T.G. (2009): Modellierung von Landschaftsentwicklungsszenarien der Offenlandflächen im Nationalpark Eifel unter Berücksichtigung verschiedener Managementvarianten (Grasland Sukzessions-Modell). In: P. Finck, U. Riecken, E. Schröder (eds.): Naturschutz und Biologische Vielfalt, BfN-Schriftenreihe, Landwirtschaftsverlag, Münster, Heft 73, S. 229-241

Contact

Silvana Siehoff
Research Institute for Ecosystem Analysis and Assessment (gaiac), RWTH Aachen University, Germany
Kackertstrasse 10
D-52072 Aachen
Germany
silvana.siehoff@gaiac.rwth-aachen.de
www.gaiac.rwth-aachen.de
www.virtueller-wald.de

3D-visualisation and remote sensing: performed by the Institute for Man-Machine Interaction (MMI), RWTH Aachen University

Monitoring data of CBD-sites: provided by Dr. Leder (Landesbetrieb Wald und Holz NRW; SPA Waldbau, Forstvermehrungsgut; LVFA Arnsberger Wald).

Implications of Climate Change for FFH-Forest Habitat Types

Nico Frischbier and Nils Feske
Service & Competence Center ThüringenForst; Saxon State Office for Environment, Agriculture & Geology, Germany

Within the framework of the interdisciplinary EU-Project HABIT-CHANGE (www.habit-change.eu) the research for Biosphere Reserve Vessertal-Thuringian Forest/Germany primarily focusses on implications of climate change for forest habitat types according to the Habitats Directive. Dependent on climate change characteristics, the actual spatial habitat distribution and the reported conservation status of habitat types, three different classes of effects and corresponding impacts on criteria for habitat structure, species composition and impairments according the evaluation matrix provided by the German federal Working Group for Conservation (LANA) and the conference of Forest Directors (FCK) could be identified:

Large-area disturbances (extreme events) resulting in homogeneous habitat structures, failure and lack of particular structural elements, drastic changes of habitat-specific species inventory and composition as well as significant impairments of forest soils, water balance and vegetation.

Small-scale and scattered damages in forest stands (species- or structure-specific a-/biotic implications) involving a heterogeneous habitat structure and stronger presence of particular structural elements, commonly easy to compensate selective loss of habitat-specific species inventory and various small-scale impairments, that can be rapidly restored.

Gradual shifts of forest site conditions (gradual climate change) leading to at most marginally improved habitat structures, stand- or habitat-specific changes in terms of species inventory, especially regarding the habitat types 91D0 & 91E0: in case of a malfunctioning water regime, 9410: on moderately moist mesotrophic, highly skeletal silicate soils, in case climate change favours European Beech and Silver Fir (transition towards 9110), 9110: on eutrophic sites, in case milder climatic conditions support the occurrence of European Ash, Sycamore Maple and Elm (towards 9130) as well as halting and rapidly compensated impairments on a small-scale.

Remarkably, large-scale disturbances encompass a devaluation risk for habitat type quality. In particular the criteria “biotope and over mature trees” and “thick deadwood” can be affected by those climate-induced effects. In the biosphere reserve there is a high vulnerability for the montane acidophilous spruce forests habitat type (9410), arising from a potentially intensified dispersion of beech. Additionally, this habitat type is exposed to storm events, especially in mountain ridges and adjacent to treeless bog areas. In the long term, climate change and corresponding impacts can involve changes in habitat structure, species composition and thus, conservation status and spatial distribution of reported forest habitats. These findings should be considered for the development of climate change-integrated conservation strategies.

Contact

Nico Frischbier
Service and Competence Center ThüringenForst
Jägerstraße 1
D-99867 Gotha
Germany
nico.frischbier@forst.thueringen.de
www.thueringenforst.de

The European Climate Adaptation Platform (Climate–ADAPT) – what it can do for you

NIKKI KENT

Climate-ADAPT is a partnership between the European Commission (DG CLIMA, Joint Research Centre and other DGs) and the European Environment Agency.

Climate-ADAPT is a European Commission initiative that aims to support Europe in adapting to climate change. It is a key element of the EU Adaptation Strategy launched in April 2013. By complementing the activities of its Member States, the European Union can support action by promoting greater coordination and information sharing between Member States, and by ensuring that adaptation considerations are addressed in all relevant EU policies. This platform is designed to help users access and share information on the extent of climate change expected for Europe and on the regions and sectors that are vulnerable to climate change both now and the future. It also provides information on adaptation strategies at a range of levels across Europe, it provides adaptation case studies and has access to specifically designed tools that support adaptation planning and decision making. The 'Adaptation Support Tool' is a good starting point for those new to Climate-ADAPT and to adaptation. This tool draws on research and practical experience from across Europe to provide a step-based framework for adaptation policy development. Each step is broken down into manageable units aligned to the policy cycle. The Climate-ADAPT database gives you access to over 1000 adaptation resources. You can perform keyword searches and advanced searches by sectors, climate impacts, adaptation elements and countries. Other key features of Climate-ADAPT are outlined below in Figure 1.

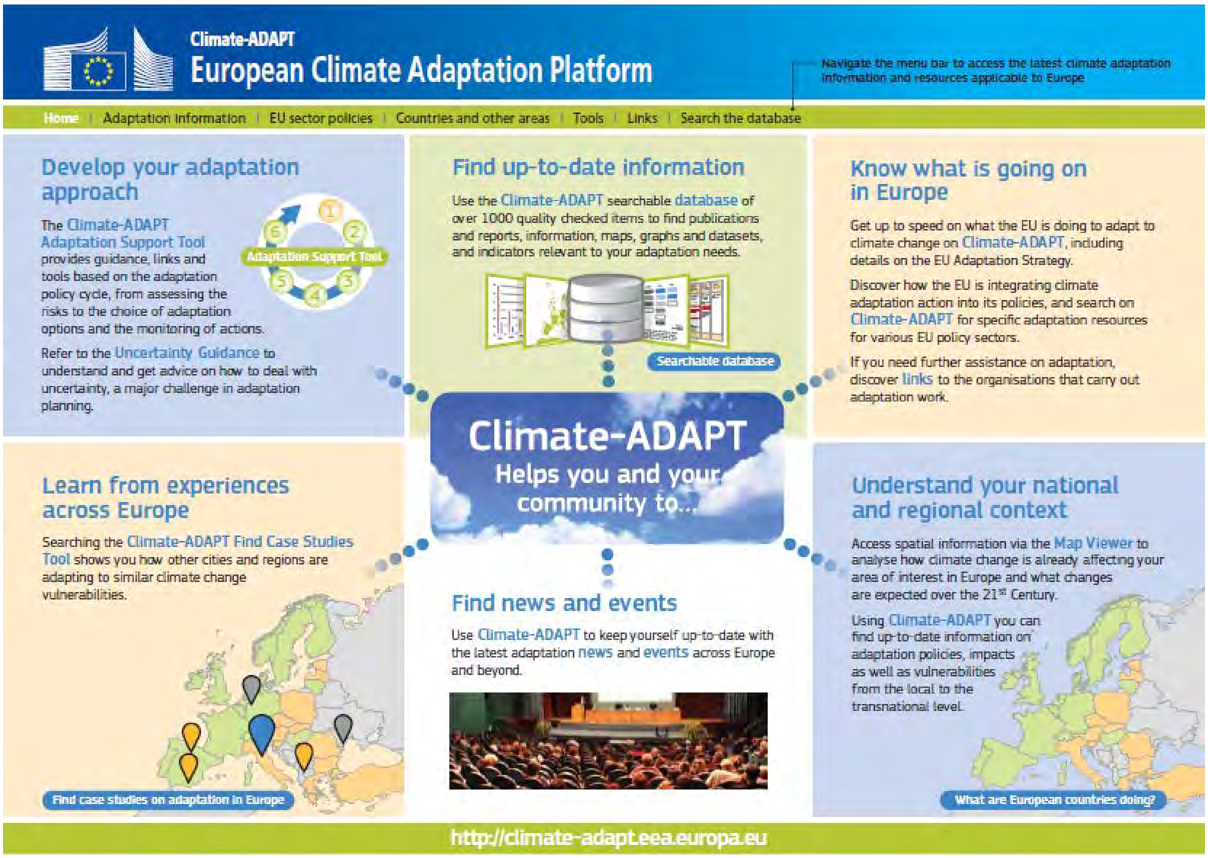


Figure 1: Climate-ADAPT's main features

Climate-ADAPT is a platform for sharing and integrating information on adaptation to climate change. It will only grow and improve with your input. Please share and promote the adaptation activities you or your colleagues are involved in. From the Home Page use the 'Share your information' link to propose content contribution with dedicated guidance on how to upload your information against the range of pre-set resources. Climate-ADAPT video tutorials will be available soon on the platform related to national and city governance, coastal management and water management. We hope that you find Climate-ADAPT useful. Please try it out for yourself and let your colleagues know about the growing number of resources available on the European Climate Adaptation Platform, Climate-ADAPT.

Contact

Nikki Kent
Ricardo-AEA
The Gemini Building, Fermi Ave, Harwell IBC, Didcot, OX11 0QR, UK
nikki.kent@ricardo-aea.com
http://climate-adapt.eea.europa.eu/ http://www.ricardo-aea.com/

Impacts of temperature and land use intensity on the floristic species diversity in grain field areas of Europe

Jörg Hoffmann, Nils Hempelmann, Michael Glemnitz und Laszlo Radics
Julius Kühne-Institut (JKI); Climate Service Center (CSC); Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; University of Budapest, Hungary

About 107 million hectares of the land area in Europe are arable land, representing 25.3% of the total land area. Over the course of the last ten thousand years arable land use has spread from areas in the East-Mediterranean across nearly the whole of Europe. Owing to this long history, agriculture creates a major habitat, and is of high significance, for biodiversity. This study analyses the impact of different climate conditions in the grain-growing regions of Europe, North Africa and Asia Minor (Fig. 1) on the floristic species diversity ('weeds'; labeled as 'segetal flora' in ecological terms) on arable land in relation to the land use intensity. Input data for the segetal flora modelling are datasets for climatic temperature downscaled with the regional climate model REMO forced by ERA-interim data (Jacob et al. 2007) and for the floristic data from European field investigations (Hoffmann et al. 2002, Glemnitz et al. 2006). The floristic data is based on several years of field studies on the segetalflora on arable fields in agricultural areas in Europe located within the climate range between 3.5 to 16.4°C. During the floristic field studies, the variants fallow fields, extensive (ecological) fields and intensive fields (with application of herbizides) were recorded separately. The results show that the floristic diversity in grain fields is essentially determined by the climate (Fig. 2, left), but currently more influenced by the kind and intensity of land use (Hoffmann et al. 2012). Exclusively intensive agricultural use leads to a strong reduction and simultaneously uniformity of floristic biodiversity in all of the grain-growing areas (Fig. 2, right). On the other hand, extensive (ecological) land use as well as parts of fallow fields are playing a substantial role for the conservation of species diversity (Hoffmann et al. 2013). If these types of land uses will not be recognized and integrated in a biodiversity preservation concept, Europe will loose a large part of its floristic species diversity in the agrar regions.

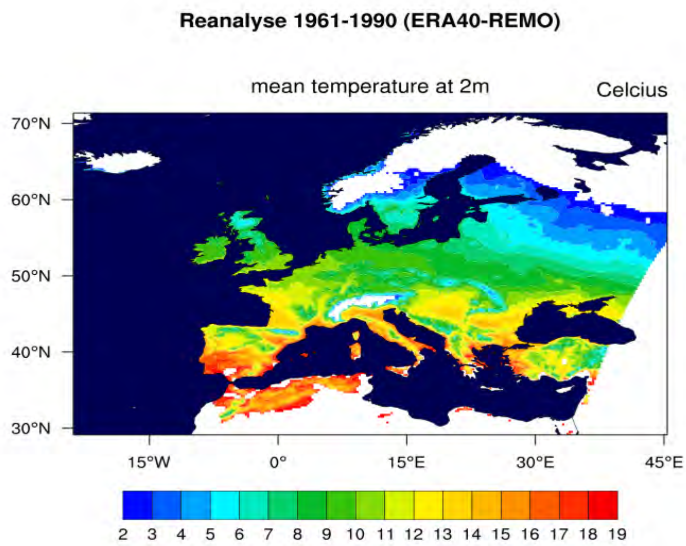


Figure 1: Modeled spatial distribution of the grain-growing regions differentiated into areas with similar temperature conditions within the range of 2°C to 19°C in Europe, North Africa and Asia Minor.

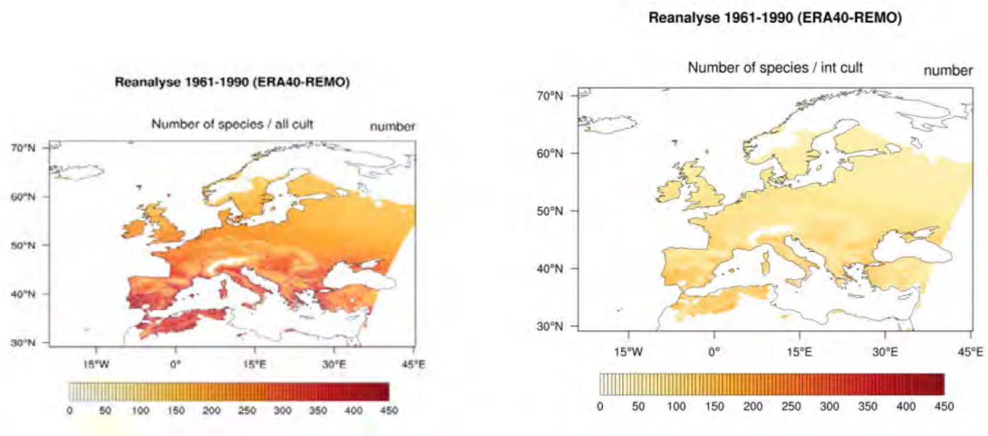


Figure 2: Modeled spatial distribution of the floristic species diversity in grain field areas of Europe, left: all forms of land use, right: only areas with intensive land use (application of herbicides) in Europe, North Africa and Asia Minor.

References:

Glemnitz, M.; Radics, L.; Hoffmann, J.& Gy. Czimber (2006): Weed species richness and species composition of different arable field types - A comparative analysis along a climates gradient from south to north Europe. Journal of plant diseases and protection 20: 577-586.

Hoffmann, J.; Czimber, Gy.; Glemnitz, M. & L. Radics (2002): Effekt eines sich verändernden Klimas auf die Unkrautflora in Europa. Angewandte Wissenschaft 494: 269-272.

Hoffmann, J.; Hempelmann, N.; Glemnitz, M.; Radics, L.; Czimber, G. & U. Wittchen (2012): Einfluss von Temperatur und Nutzung auf die floristische Artenvielfalt in Getreideanbaugebieten Europas. Julius-Kühn-Archiv 436: 70-76.

Hoffmann, J.; Wittchen, U.; Hempelmann, N.; Glemnitz, M. & L. Radics (2013): Floristische Vielfalt auf Äckern: Ökologischer Landbau – eine Option für floristischen Artenschutz? Forschungsreport Spezial Ökologischer Landbau, im Druck.

Jacob, D.; Barring, L.; Christensen, O.B.; Christensen, J.H.; de Castro, M.; Deque, M.; Giorgi, F.; Hagemann, S.; Lenderink, G. & B. Rockel (2007): An inter-comparison of regional climate models for Europe: Model performance in present-day climate. Clim. Change 81: 31–52

Contact

Dr. agr. Dr. rer. nat. Jörg Hoffmann
Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants
Institut for Strategies and Technology Assessment, -Sustainable Agriculture and Biodiversity-
Stahnsdorfer Damm 81
D-14532 Kleinmachnow
Germany
Tel.: (++49) (0)33203 48360, Fax: (++49) (0)33203 48424
joerg.hoffmann@jki.bund.de
www.jki.bund.de

The influence of different mowing concepts on true bugs (heteropterans) of urban areas in Tübingen

Philipp Unterweger, Oliver Betz
Universität Tübingen, Germany

Keywords: species diversity, meadow, wildflowers, Baden-Württemberg, insect communities, vegetation management, nature conservation, public green areas, mowing, cutting

2010 was the year of biodiversity that motivated a group of students and academics of the University of Tübingen (Southwest Germany) to found an initiative called "Bunte Wiese" (i.e. colourful meadow). Its primary concern was to improve the biodiversity in urban public areas, such as meadows, lawns, and forests (either in parks or surrounding public buildings that can be considered places most natural to be found in a city) (Unterweger et al. 2012). The goal was to optimise the management of the grassland areas to improve their quality with respect to conservational and ecological issues. Administrative authorities and cooperating scientists helped to develop and implement this concept to improve the biodiversity in the inner city. Several scientific student theses investigated heteropterans (Unterweger 2013), colepterans (Ade et al. 2012), lepidopterans (Kricke 2011), bees (Ruoff 2011), and the herbaceous flora (Schnee 2010) on intensely cut meadows *versus* extensively cut ones. They showed that the diversity of these insects and plants was significantly lower in areas that were regularly mowed (once a month) compared to areas that were mowed only twice a year. This supports our claim to implement a novel management concept comprising a more extensive mowing regime in urban public grassland areas.

References

Ade, J.; Wolf-Schwenninger, K. and O. Betz (2012): Auswirkungen der Wiesenmahd auf verschiedene Käferarten ausgewählter Grünflächen im Stadtgebiet Tübingens. Jahreshefte der Gesellschaft für Naturkunde in Württemberg 168: 199-216.

Kricke, C. (2011): Einfluss verschiedener Mahdkonzepte auf die Artenvielfalt der Tagfalter auf Grünflächen der Stadt Tübingen. Evolutionsökologie der Invertebraten, Tübingen. Bachelor.

Ruoff, L. (2011): Auswirkungen der Wiesenmahd auf die Wildbienenfauna öffentlicher Grünflächen in Tübingen. Evolutionsökologie der Invertebraten, Tübingen. Diplomarbeit.

Schnee, L. (2010): Plant diversity on public areas in Tübingen. Vegetationsökologie. Tübingen, Tübingen. Bachelorarbeit.

Unterweger, P. (2013): Der Einfluss verschiedener Mahdkonzepte auf die Wanzenfauna im Stadtgebiet Tübingens. Evolutionsbiologie der Invertebraten. Tübingen, Universität Tübingen. Staatsexamen.

Unterweger, P.; Ade, J.; Braun, A.; Kotzenburg, M.; Kricke, C.; Schnee, L.; Wastian, L. and O. Betz (2013): Langfristige Etablierung extensiver Grünflächenpflege in Stadtgebieten. Die Initiative "Bunte Wiese" der Stadt Tübingen. Treffpunkt Biologische Vielfalt XII: Interdisziplinärer Forschungsaustausch im Rahmen des Übereinkommens über die biologische Vielfalt. U. Feit, Korn, H. Insel Vilm (Hrsg.), BfN-Skripten 335.

Contact

Philipp Unterweger
Universität Tübingen
Institut für Evolution und Ökologie
Evolutionsbiologie der Invertebraten
Auf der Morgenstelle 28E
D-72076 Tübingen
philipp.unterweger@student.uni-tuebingen.de

Green roofs: an environmental tool for the Mediterranean city

RIGUCCIO L., TOMASELLI G.
University of Catania, Italy, DiGeSa (Department of Agri-food and Environmental Systems Management)

1. Aim and Methodology

The Mediterranean environment has particular characteristics which require in depth study particularly with respect to urban and anthropic areas.

This means that planning and building green roofs requires the study of a model which in terms of technology, composition and species choice is suited to Mediterranean characteristics.

Species choice in the Mediterranean as regards climatic adaptability can count on thousands of species.

One proposal for roof gardens according to local context was: the use of Mediterranean landscape through specific planning techniques and xeriscaping using drought-tolerant plants.

In this work, a procedural methodology was developed which leads to the formulation of specific 'green' construction techniques for the Mediterranean environment which are applicable to roof gardens.

Picking out examples in strongly anthropic contexts within the Mediterranean which presented diverse problems among those analysed helped identify the construction types and characteristics. So, guidelines were drawn which highlight the specific techniques to build a roof garden suitable for a Mediterranean city.

2. Analyses and results

The re-naturalisation of the city is one of the new frontiers in urban and territorial planning. The difficulty of finding areas adapt as green spaces is common. Creating roof gardens is an efficient method in support of the new town planning theories and of the concept of 'a green system to compensate that which was suppressed'.

From project analyses, most reference is made to adopting the specific techniques of: Mediterranean landscape **and** xeriscaping.

A proposal to use suitable methods to build roof-gardens according to the local context is adopting this strategy: xeriscaping using drought-tolerant plants.

3. Conclusions

Covering high percentages of urban areas in sealed and weatherproofed pavement is not just an aesthetic problem but also one which has affected the environment and ecosystems.

Through bio-mitigation, plants and green roofs can contribute in reducing urban heat. Furthermore, sustainable planning as well as optimum landscape planning, can considerably improve urban microclimates and consequently the quality of life.

References

Baines, C. (1987): The future management of vegetation in the urban environment. Acta Horticulturae, 195: 43-48.

La Malfa, G. (1987): La scelta della specie in rapporto alla tipologia del verde urbano. Atti del seminario di Studi su “Progettazione e conservazione del verde urbano”, Caltanissetta.

Osmundson, T. (1999): Roof Gardens - History, design and construction, - Norton

Abram, P. (2004): Giardini Pensili — sistemi editoriali — Esselibri simone

Fiori, M.: - Verde pensile e benessere ambientale—Osservatorio de verde— Legamiente Milano

Contact

Riguccio Lara
DiGeSa (Department of Agri-food and Environmental Systems Management)
University of Catania
Via Santa Sofia, 100
Catania – 95123
Italy
riguccio@unict.it
http://www.digesa.unict.it

Intervention methodologies to enhance Sicilian rural coastline landscape within climate change

RIGUCCIO, L.; RUSSO, P.; CARULLO, L.; TOMASELLI, G.
University of Catania, Italy, DiGeSa (Department of Agri-food and Environmental Systems Management)

Objectives

Nowadays with climatic change, global warming and desertification needing urgent attention and concrete responses, rational use of the planet's resources and safeguarding the global ecosystem are essential presuppositions for sustainable development together with economic prosperity and balanced social quality.

It is well known that these tensions are most exacerbated in strongly anthropic areas like those of the agro Sicilian coastline. In most of these areas, extensive overbuilding due to urban, industrial and tourism sprawl, and intensive agriculture have above all impoverished the coastline, depleted typical Mediterranean vegetation, eroded the soil, and therefore modified the environment. This work proposes to analyse parts of the Sicilian agricultural landscape, in Ragusa territory, to acquire data on the factors determining the evolution of this degradation and elaborate intervention methodologies within climate change.

Methods

To identify the specific indicators for the agro-coastal landscape capable of highlighting the involutional processes responsible for desertification, the work will proceed in the following phases:

- identify sample areas where human pressure is evident and which are in danger of desertification;
- investigate the evolution/involution of the landscape;
- describe the current characteristics of the landscape;
- evidence of potential landscape modification;
- Identify intervention methodologies.

Results

An interpretive synthesis of the landscape will form the basis for identifying the indicators which the research will reveal and compare with those conventionally adopted to identify desertification.

Furthermore, the acquired data should provide a useful basis to identify opportune methodologies to conserve or restore the ecological and functional equilibrium without neglecting those aspects tied to the identity of place with the aim of orienting government policy.

References

AA.VV. (2007): Final part of the IPCC's Fourth Assessment Report (AR4), IPCC.

Riguccio, L.; Falanga, C.; Failla, A.; Tomaselli, G. (2008): "Riqualificazione del paesaggio agro-urbano costiero: un caso studio per la città di Catania". Agribuisness Landscape & Environment Management

Riguccio, L.; Falanga, C.; Tomaselli, G.; Failla, A. (2009): “La riqualificazione paesaggistica del territorio agro-urbano-costiero ragusano nel contesto della desertificazione”. IX Convegno Nazionale AIIA.

Russo, P.; Riguccio, L. (2009): “Metodologia di gestione sostenibile del Paesaggio Agro-UrbanoCostiero Mediterraneo. AISSA

Schifani, G. (2006): Problematiche e prospettive economiche del ruolo dell’agricoltura nella lotta alla desertificazione, ESAF.

Contact

Riguccio Lara
DiGeSa (Department of Agri-food and Environmental Systems Management)
University of Catania
Via Santa Sofia, 100
Catania – 95123
Italy
riguccio@unict.it
http://www.digesa.unict.it

Biodiversity criteria for Germany's International Climate Initiative

Robert Munroe, Alana Williamson, Rebecca Mant, Lennart Kuemper-Schlake, Christian Grossheim

UNEP World Conservation Monitoring Centre, UK; Bundesamt für Naturschutz (BfN) Federal Agency for Nature Conservation, Germany

The German International Climate Initiative (ICI) has an annual budget to fund projects on greenhouse gas emissions reduction, forest conservation and adaptation to climate change in developing countries, emerging economies and transition countries. To date, consideration of biodiversity in ICI's funding and evaluation guidelines has not been wholly systematic. Therefore, a project has been developed between the German Federal Agency for Nature Conservation (BfN) and the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), with support from BirdLife International. The aim of the project is to incorporate biodiversity conservation criteria into the funding and evaluation guidelines of ICI projects targeting forests and wetlands, as well as improving the integration of biodiversity issues in climate change mitigation and adaptation projects in general. This poster summarises how the criteria and associated guidance have been developed, the current criteria and guidance, the results of recent testing with present and past ICI project leaders, the next steps, and lessons learnt for other climate change funds.

The criteria are split into 3 categories covering: compliance with and contribution to policies, identifying and mitigation impacts on biodiversity and ecosystem services, and using biodiversity and ecosystem services to maximise synergies between climate change adaptation, mitigation and sustainable development. Accompanying guidance for project proposal writers and project selectors and evaluators has also been developed. The criteria and guidance were informed by a review of scientific literature and existing standards/criteria related to forests and wetlands climate change mitigation and adaptation projects (e.g. UN-REDD Social and Environmental Principles and Criteria, Climate, Community and Biodiversity Alliance REDD+ Social and Environmental Safeguards), advice from an expert advisory group, and by an expert and project manager workshop. Most recently, the criteria were tested through comparing present ICI project proposal and evaluation forms with the suggested required information within the criteria, and by a survey of a sample of project leaders to note their views on the clarity, reasonableness/feasibility, and utility of the criteria/guidance.

Results from the testing revealed that further guidance is necessary on how to develop indicators of compliance with the criteria, and how to monitor those indicators, taking into account the range of projects funded by ICI (in terms of funding scale, differing country circumstance and project-type, e.g. site implementation or programme/policy development). This will be the subject of a workshop later this year.

The criteria have also been integrated into the complementary project on monitoring and reporting guidelines in the ICI undertaken by a Umweltbundesamt-led consortium of Ecofys, Germanwatch and Wuppertal Institute. One notable lesson for other climate change funds is the need to find the right balance between the need to demonstrate compliance with selection criteria and the financial obligation of additional monitoring requirements.

Contact

Robert Munroe
UNEP World Conservation Monitoring Centre
219 Huntingdon Road
Cambridge, CB3 0DL
United Kingdom
robert.munroe@unep-wcmc.org
www.unep-wcmc.org

Natural environment adaptation manual

Simon Duffield, Nicholas Macgregor, Mike Morecroft, Andy Neale,
Malcolm Ausden, Olly Watts
Natural England, UK; RSPB

Natural England, the RSPB and other partners are developing a practical web guide to help identify and to take practical adaptation for conservation in response to climate change. The manual gives detailed guidance on effective and practical adaptation action for a wide range of semi-natural habitats. It also guides users through assessment and decision making processes to enable appropriate objectives and actions to be developed.

Approaches to adaptation and decisions making

The guide takes readers through the principles of adaptation; including the dual approach of increasing resilience and accommodating inevitable change; the potential transformation of habitats; the reviewing of objectives; the strategic relevance of sites; the value of working with others; dealing with uncertainty; and the importance of acting now.

The basic elements of vulnerability are covered, looking at exposure, sensitivity and adaptive capacity and how these apply to conservation management. This includes consideration of changes in local climate (and how site-level factors might affect these); identifying which species and ecosystems are most sensitive to those changes (and how site-specific factors can potentially mediate or exacerbate the effects); and the potential for human intervention to manage conditions.

The manual explains how to consider spatial scale, from smaller-scale microclimates and microhabitats, to the scale of individual sites and protected areas, and then to adaptation across landscapes.

Practical habitat database for action

The main part of the manual provides information on the specific climate change threats and practical responses for a wide range of semi-natural habitats. Information for each habitat includes: climate change sensitivity and the main causes of vulnerability; key characteristics, species and management; distribution in England; potential direct and indirect impacts of climate change; a detailed description of the adaptation responses for the habitat; relevant agri-environment options; and links to further information and advice.

The database covers the main habitats of conservation interest and concern for England. These include: blanket bog, broad leaved woodland, calcareous grassland, coastal grazing marsh, coastal sand dunes, lowland heathland, lowland meadows, parkland and wood pasture, rivers and streams, standing waters and upland hay meadows.

Case studies are an important part of the manual, which contains examples of the issues caused by climate change for conservation habitats, and the practical action that have been taken. These include changes in vegetation management regimes, restoring and creating lowland heathland to reduce fragmentation, developing flexible water management at wetland reserves, and major coastal projects such as Wallasea Island coastal realignment.

Contact

Simon Duffield
Natural England
2nd Floor, Cromwell House
15 Andover Road
Winchester, SO23 7BT
simon.duffield@naturalengland.org.uk
http://www.naturalengland.org.uk/

Annex 1
ENCA conclusions and recommendations following the international conference "Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective"

October 2013

Introduction

The international conference "Climate Change and Nature Conservation in Europe – an ecological, policy and economic perspective", held on 25 - 27 June 2013 in Bonn, Germany, was organised by the German Federal Agency for Nature Conservation (BfN) in co-operation with the ENCA Climate Change Group and the Free University of Berlin.

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. Some of the latest scientific findings on the impacts of climate change on European ecosystems and their ecosystem services were presented, along with information about appropriate conservation measures. This was followed by interactive sessions focusing on i) specific requirements and solutions for different ecosystems and the species they support; ii) connecting with people and iii) adaptation planning. Finally, discussions considered current European policy and economic issues in climate change and nature conservation, leading to recommendations for climate change-adapted nature conservation in Europe.

Putting principles into action

The following recommendations were developed by the ENCA group at a follow-on workshop, based on the conference presentations, workshop session outcomes and plenary discussions. They build on the 2011 ENCA recommendations (Korn et al. 2012) and focus on ways forward to put principles into action[1]. The recommendations highlight four main priorities to enable significant steps towards implementation, with a range of actions under each. This includes some specific actions that ENCA could take.

- Enhance communication and cross-sectoral collaboration for integrated adaptation management and planning. This should be considered as an ongoing process in order to reduce the risks of maladaptation and to address the time lag between research and implementation and the existing uncertainties. Specific actions include:
    - Ensuring cross-sectoral and transboundary cooperation for the long term. Linking conservation managers, scientists, and decision makers from various disciplines and sectors into advising bodies to move towards coherent policy delivery and action.
    - Employing resources for forecasting and joint participatory spatial planning approaches (e.g. the Polyscape adaption scenario approach using Google Earth).

[1] These recommendations were welcomed by the ENCA network at its 13th plenary meeting, held in Bonn/Germany, in October 2013

- Communicate the potential losses and gains from climate change and the multiple benefits of adaptation to increase the awareness and response of policy makers and the public. Encourage joint action and acceptance of responsibility by:
    - Showcasing success stories as well as learning points from failures.
    - Promoting a meaningful interface and active knowledge exchange and collaboration between practitioners, scientists and policy makers (including cross-boundary collaboration). This can be achieved through encouraging engagement among multiple stakeholders, supporting interface communicators and facilitating networks.
    - Creating clear, simple indicators for the public (e.g. red list and vulnerability index)
    - Enhancing communication and awareness-raising of climate change impacts in nature conservation, risks and opportunities, and adaptation options through ecosystem-based solutions. One particularly important example is water (European Commission 2012): biodiversity strongly depends on healthy water systems and is influenced by availability, quality and temperature of water. Natural systems, forests and properly managed arable systems (e.g. organic farms) have the ability to store and retain water in the sub-soil; protecting and enhancing these areas can play a major role in supplying water (to both natural areas and for other land uses) in dry periods or retaining it in flooding events. This makes ecosystem-based adaptation an important tool in preserving both ecology and economy, and the multiple benefits of such approaches need to be communicated to decision-makers and the general public.
    - Highlighting the benefits people derive from nature and the synergies and trade-offs of management options for bidoiversity and human well-being by linking to TEEB international and country studies (The Economics of Ecosystems and Biodiversity **www.teebweb.org**).
    - Conducting a European assessment of climate and ecosystem service change and adaptation options.
- Foster action: optimise the current investments into Green Infrastructure and Natura 2000 that deliver the ability to adjust to change (with a focus on enlarging, connecting and improving areas). This can be achieved by:
    - Setting clear priorities (what action is most important, and where)
    - Fully integrating consideration of the potential effects of climate change into conservation site management, especially in Natura 2000 sites. Climate change adaptation may require adjustment of current management goals and practices, and ENCA will need to consider these align with the Habitats Directive
    - Applying the EU ‘Guidelines on dealing with the impact of climate change on the management of Natura 2000’ (Bouwma et al. 2012)
    - Harnessing the opportunities provided by the generic requirement for all EU funds (including LIFE+), to have a significant percentage of ca 20% focused on climate change delivery including adaptation. Therefore ENCA might take on an advisory and coordinating role in fostering action on climate change, including ecosystem-based adaptation (EbA) and ecosystem-based mitigation (EbM), in LIFE+ bids through habitat restoration, enhancement and protection. This may concern especially habitats with carbon rich soils such as peatlands, and joining up initiatives across Europe

    - Reaching out to other cross-sectoral EU work programmes on climate mitigation and adaptation to include nature based solutions (as well as to avoid trade-offs with other mitigation options, e.g. through biofuel production)
- Monitor and increase understanding of change: promote long-term ecological research and monitoring across European ecosystems to assess impacts of climate change. Use demonstration sites and experimental approaches to assess effects of adaptive management, and encourage recording of change at conservation site level to enable learning and understanding of effects.
    - Targetting research to review and synthesise existing climate adaptation actions in conservation across different European countries (similar to the PEER review on national adaptation strategies, Swart et al. 2009). This would help to improve our understanding of the factors that support or constrain adaptation and how ENCA could help address them. It is particularly important to consider the Mediterranean, which has been under-represented in past surveys and discussions. Joint research by ENCA agencies would help to address this
    - Investigating the role of micro-climate and heterogeneity in safeguarding existing conservation sites and contributing to conservation strategies.
    - Realising consistent monitoring programmes across Europe.
    - Engaging in the European Biodiversity Observation Network (EU BON www.eubon.eu), the Long-term Ecological Research Network (LTER www.lter-europe.net), Future Earth (www.futureearth.info) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES www.ipbes.net).
    - Developing simple protocols for conservation managers to monitor change and engage in citizen science approaches to enhance data collection and increase the sense ownership local communities have for conservation areas.

References

Bouwma, I.M.; Vos, C.C.; Biemans, M.; McIntosh, N.; van Apeldoorn, R. & P. Verdonschot (2012): Guidelines on dealing with the impact of climate change on the management of Natura 2000. Publications Office of the European Union, Luxembourg.
http://ec.europa.eu/environment/nature/climatechange/pdf/N2_CC_guidelines.pdf

European Commission (2012): A blueprint to safeguard Europe's water resources. European Commission. http://ec.europa.eu/environment/water/blueprint/

Korn, H.; Kraus, K. & J. Stadler (2012): Proceedings of the European conference on Biodiversity and Climate Change - Science, Practice and Policy. BfN-Skripten 310. Bundesamt für Naturschutz, Bonn.
http://www.bfn.de/fileadmin/MDB/documents/themen/biologischevielfalt/Klimaseite/Skripten/Skript_310.pdf

Swart, R.; Biesbroek, R.; Binnerup, S.; Carter, T.R.; Cowan, C.; Henrichs, T.; Loquen, S.; Mela, H.; Morecroft, M.; Reese, M. & D. Rey (2009): Europe adapts to climate change: Comparing national adaptation strategies. PEER Report No 1. Helsinki: Partnership for European Environmental Research.
http://www.peer.eu/fileadmin/user_upload/publications/PEER_Report1.pdf

Annex 2
IUCN Vice President’s contribution to the ENCA/BfN Conference panel discussion

Presented by Marina von Weissenberg

Prepared by Francois Rogers (Gender), Radhika Murti (Disaster Risk Reduction), Ali Raza (Ecosystem based Adaptation), and Edmund Barrow (Head, Ecosystem Management Programme)

Introduction

With respect to climate change adaptation IUCN is taking a focus on Ecosystem based Adaptation (EbA) that uses Nature Based Solutions. Sometime this might be done in conjunction with more infrastructure type adaptation, for example combining sea walls with mangrove restoration in adjoining areas. Importantly EbA approaches can bring important co-benefits – both for people and for the environment, as well as enhance their ability in the face of the ever increasing numbers of disasters. Gender differentiated approaches are key to this, as women are often those most impacted by disasters and by the effects of climate change.

Examples of EbA type approaches include the following:

- Building Adaptive Capacities for EbA
- Integrating indigenous knowledge and institutions
- Improving local governance over land/water/natural resources
- Agroforestry (with appropriate species that are better adapted to CC)
- Soil conservation and management
- Ecosystem restoration with species that are better adapted to warmer conditions;
- Catchment management that takes into account increased climate risk
- Management of Invasives
- Diversification of land use and livelihood options to spread risk, enhance resilience
- Crop diversification that embraces varieties that take into account climate change;
- Seasonal movement of people and livestock between winter and summer pastures;
- Conserving and better management of ground water
- Enhancing connectivity in the landscapes
- Protecting and restoring natural infrastructure (dunes, mangroves, forests etc.)

Many of these approaches are not new, and here it is important to be able to demonstrate the “additionality” of the work so the activities do actually help in adaptation. Additionality might include improved governance, greater risk spreading, working with restoration that uses species adapted to changing climate scenarios.

Many of IUCN’s thematic and regional programmes are working with EbA, and a number of them have received funding through BMU/ICI – for this IUCN is very appreciative of the trust that BMU have with us. Building on this IUCN is developing an “EbA learning framework (attached as a separate file)” which will shortly be rolled out Union wide, and will, we hope provide much stronger and more empirical data on using nature based solutions for EbA. In addition IUCN is working closely with the Secretariat of UNFCCC (especially the Nairobi Work Programme) on EbA.

Ecosystem-based Adaptation (EbA)

1. Ecosystem-based Adaptation (EbA) integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both existing climate vulnerability, and long term climate change.
2. Nature based solutions, that is Ecosystem-based Adaptation, not only works towards reducing vulnerability to both climate and non-climate risks but also directly and indirectly offers multiple economic, social, environmental and cultural benefits.
3. Ecosystem based adaptation measures ensure conservation and restoration of ecosystems and their services. This directly contributes towards mitigation as healthy forests store and sequesters carbon. This also then supports in water recharge and improving water quality. A study (Dudely et al. 2003) shows that about one third of the world's largest cities get their water supply from forested areas.
4. Through EbA measures, conserved and protected ecosystems help in biodiversity conservation and enhance communities' ability to sustain livelihoods through providing services such as fisheries, non-timber forest products and direct benefits to sustainable agriculture and livestock.
5. EbA initiatives directly compliment as well as supplement disaster risk reduction as ecosystems act as natural barriers against cyclones, storm surges, strong winds, floods etc. Also, pre disaster environmental conditions contribute in dealing with the impacts of disasters and help in early recovery. The unfortunate Asian Tsunami (2004) provided exceptional examples where pre-disaster environmental conditions played critical 'life & death' role. That is, many a lives were saved or lost because of the buffer provided by healthy ecosystems in the shape of sand dunes (most effective) and dense mangroves/forest cover. In one resort in Southern Sri Lanka where sand dunes were removed for 'better viewing' of sea by the guests, 24 people died and in the adjoining village people were saved with little damage to mud houses due to intact sand dunes with vegetative cover.
6. It was observed after a year of Tsunami that coral reefs which were in good condition before the tsunami struck recovered much faster than degraded sites throughout Sri Lanka especially at marine conservation project sites such as in the Hikkaduwa National Park, Sri Lanka.

Disaster Risk Reduction (DRR)

Why nature based solutions are critical to adaptation? While there is a lot of value for DRR and CCA interventions to be aligned and integrated (in order to deal with both short and long term impacts and changes), there is limited knowledge and best practices on how to achieve this. Nature based solutions are increasingly proving to be an effective mechanism for integrated approaches between DRR and CCA.

What we need to do - and what we are doing - to turn these into action:

- IUCN is working with research institutes and selected Governments to establish scientifically credible evidence/approaches AND effective policy mechanisms on how nature based solutions can reduce the risks to disasters (such as landslides and avalanches) in the short term and help communities adapt to climate change impacts in the longer term. The Ecosystems Protecting Infrastructure and Communities – EPIC, is one such project that IUCN is implementing with various partners in 6 countries. More details can be found on IUCN's website.

- In Bangladesh and India, IUCN is working with communities to manage watersheds for floods as well as for climate risks.

Gender and Adaptation and Ecosystem based Adaptation (EbA)

Challenging power relations, addressing inequality and upholding human rights might seem a long way off from adapting to climate change. But the logic is that people are vulnerable to climate change because of the unequal power structures in their society.

1. Adaptation measures reveal the **human dimension** of climate change. When we therefore focus on gender in adaptation, it is about reducing vulnerability to current and projected climate risks – determined by people's adaptive capacity.
2. Both women and men are affected by climate change, but existing **inequalities** determine who is most impacted by natural disasters. Climate hazards therefore do not affect everyone equally: some people have a greater capacity than others to manage the crisis.
3. Inequitable distribution of **rights, resources and power, cultural rules and norms** constrains people's ability to take action: especially women.
4. Therefore, **gender is a critical factor** in understanding vulnerability to climate change and in building climate resilient communities.
5. Understanding gender within the framework of vulnerabilities due to climate change and associated adaptation is, however, extremely **complex**. These frequently manifest in various ways, including but not at all limited to:
    a. Existing patriarchal systems pre-determine to a considerable degree women's role and responsibilities, mobility and sexuality in society;
    b. There is, by enlarge, an emphasis on reproductive value, and access to higher education, are hence forth more limited than is the case with boys;
    c. Women's responsibilities include family maintenance and ensuring of, and caring for, next generations; and
    d. Within the household, women enjoy limited access to resources, property, education, income-generating opportunities and control of resources.
6. **Climate change adds on to these existing gendered inequalities** and accentuates the plights of women in general compared to men.
7. Whilst women faces the same or similar stresses to men on climate change, there are certain **biophysical stresses** they suffer due to climate change.
8. Finally, all these become **compounded** as matters relating to climate change issues, associated policies and programs are not gender neutral and not recognizing that men and women have **different needs and interests** in adaptation efforts.
9. EBA includes local and landscape-based strategies for managing ecosystems to increase resilience, maintain essential ecosystem services and reduce the vulnerability of people, their livelihoods and nature in the face of climate change.
10. When we consider vulnerabilities, or the role that women and men can play as change agents, the starting point is an analysis of the differentiated **relationship women and men have with environmental resources**.
11. Women and men **relate differently** to the environment for a combination of the following reasons:
    a. Level of dependence on environmental subsistence resources;
    b. Unequal relations in using, having access to, and controlling resources, and in the distribution of benefits;
    c. Ownership of, and rights to, resources; and

d. Differentiated knowledge about resources, their products and environmental problems.

12. When ecosystems become more fragile and natural resources are totally lost or are out of reach, **poor communities** – that depend on them for their survival – are the **most affected, particularly women**.
13. Because women use and manage natural resources in a way that is different from men, and degradation of natural resources affects them differently, these **patterns of disadvantage may increase** with the change in or loss of natural resources associated with climate change.
14. As is the case for all climate action, women are also important agents of change in adaptation: their unique knowledge is essential for measures and policies to be **optimally effective and efficient**.
15. **Full, effective and meaningful participation of women** is therefore essential in order to make the best use of their knowledge and experience.
16. There are many examples where **empowering women to exercise leadership** within their communities contributes to climate resilience, ranging from disaster preparedness in Bangladesh, Indonesia and Nicaragua, to better forest governance in India and Nepal, to coping with drought in the Horn of Africa.

Annex 3
Programme of Oral Presentations

25 June 2013		
8.00 - 18.00	**Registration** Put up posters / exhibition foyer	Foyer
9:00	**Introduction and Opening** Beate Jessel, Horst Korn, German Federal Agency for Nature Conservation (BfN)	Main Lecture Theater
9:15	**Welcome and update from ENCA** Nicholas Macgregor, Natural England/ European Network of Heads of Nature Conservation Agencies (ENCA)	Main Lecture Theater
Climate Change in Europe – Impacts, Vulnerability & Conservation Tools		
9:30	**Keynote: Climate Change in Europe** Hartmut Grassl, Max Planck Institute for Meteorology, Hamburg, Germany	Main Lecture Theater
10.00	**Keynote: Biodiversity Conservation in a Changing Climate** Chris Thomas, University of York, UK	Main Lecture Theater
10:30	Tea & coffee	Foyer
11:00	**Keynote: New developments in monitoring and modeling climate change impacts on biodiversity: what can we learn for nature conservation?** Katrin Böhning-Gaese, Director, Biodiversity and Climate Research Centre (BiK-F), Frankfurt, Germany	Main Lecture Theater
11:30	**Enhancing resilience in natural environments** Mike Morecroft, Head of Profession, Climate Change Natural England, UK	Main Lecture Theater
11:50	**Conservation strategies for species - meeting the challenges of alien species and endangered species** Gian-Reto Walther, Federal Office for the Environment, Switzerland	Main Lecture Theater
12:10	**Discussion**	Main Lecture Theater
12:30	Lunch / Press conference	Foyer / Seminar Room A
14:00	**Ecosystem-based approaches to adaptation** Timo Kaphengst, Ecologic, Germany	Main Lecture Theater
14:20	**Climate Change Adapted Management in Protected Areas - Practical Experiences from Central and Eastern Europe** Sven Rannow, Marco Neubert, Leibniz Institute for Ecological Urban and Regional Development, HABIT-CHANGE project, Germany	Main Lecture Theater

Ecosystems and climate change		
14.40	**Conserving European Forests under a Changing Climate?** **Analyzing the Science - Policy Debate** Georg Winkel, Universität Freiburg, Germany	Main Lecture Theater
15:00	**Mountain ecosystems in a changing climate** Christian Körner, Universität Basel, Switzerland	Main Lecture Theater
15:20	**Adapting grassland ecosystems to a changing climate** Andras Báldi, Centre for Ecological Research, Hungarian Academy of Sciences, Hungary	Main Lecture Theatre
15:40	Tea & coffee	Foyer
16:10	**Peatland conservation – Conservation to foster** **climate mitigation and adaptation** Franziska Tanneberger, Universität Greifswald, Germany	Main Lecture Theatre
16:30	**Climate Change and Mediterranean Coastal Areas: Understanding the Impacts and Developing Adaptation Strategies** Gianluca Sarà, University of Palermo, CIRCLE-Med Research Programme, Italy	Main Lecture Theatre
16:50	**Urban ecosystems – helping cities to adapt to a changing climate** Ingo Kowarik, Technische Universität Berlin, Germany	Main Lecture Theatre
17:10	**Adapting to Climate Change in Nature Conservation in Europe** Aletta Bonn, Freie Universität Berlin, Germany	Main Lecture Theatre
17:30	**Discussion**	Main Lecture Theatre
17:45	Break	
18:00	Open Event/ Public evening lecture **Welcome** Beate Jessel, German Federal Agency for Nature Conservation (BfN) **Climate change, impacts and vulnerability in Europe** Jacqueline McGlade, former Executive Director European Environment Agency (EEA)	Main Lecture Theatre
19:00	Conference buffet / evening reception	Foyer

26 June 2013				
9:00	**Introduction and review of day 1** chair: Nicholas Macgregor, Natural England/ European Network of Heads of Nature Conservation Agencies (ENCA)			Main Lecture Theater
9:05	**Keynote: Managing the Natura 2000 network in the face of climate change – challenges and opportunities** Micheal O'Briain, DG Environment, European Commission, Brussels, Belgium			Main Lecture Theater
9:35	**Keynote: Novel freshwater ecosystems in a changing climate: A challenge for research and conservation** Klement Tockner, Director Leibniz Institute of Freshwater Ecology and Inland Fisheries, IGB, Germany			Main Lecture Theater
10:05	**Interactive sessions plan** Horst Korn, German Federal Agency for Nature Conservation (BfN)			Main Lecture Theater
10:10	Tea & coffee			Foyer
Demonstrating good practice in adapting to climate change in conservation				
	Seminar Room A	Seminar Room B	Seminar Room C	Main Lecture Theater
10:30	**Interactive Session: Mountain & subarctic ecosystems** chair: Christian Körner, Universität Basel, Switzerland	**Interactive Session: Rivers, lakes and riparian ecosystems** chair: Gordana Beltram, Director at Park Skocjanske jame, Slovenia	**Interactive Session: Coastal & marine ecosystems** chair: Maria Laamanen, Helsinki Commission (HELCOM), Finland	**Interactive Session: Grassland & Urban ecosystems** chair: Franz Essl, Federal Office for the Environment FOEN, Austria
10:30	**Climate change in Bucegi mountain - Natura 2000 habitats sensitivity** Anca Sârbu, Georg Janauer & Iris Wagner-Lücke University of Bucharest, Romania, University of Vienna, Austria	**Helping nature adapt to climate change in Scotland: showing how it can be done** Christina Bell Scottish Natural Heritage, Fort William, UK	**Green Infrastructure – A tool for reducing Europe's vulnerability to climate change** McKenna Davis, Sandra Naumann, Timo Kaphengst, Mav Pieterse, Matt Rayment & Elta Smith Ecologic Institute, Berlin, Germany, GHK, London, UK	**Can agri-environment schemes deliver adaptation for the natural environment?** Simon Duffield, Trevor Mansfield & Mike Morecroft Natural England, Winchester, UK
10:45	**Peatlands in the Arctic – the global value of ecosystem services** Tatiana Minayeva, Olivia Bragg, Peter Kershaw & Andrej Sirin Wetlands International, University of Dundee, UK, University of Alberta, Canada, Institute of ForestScience, Russian	**Riparian ecosystems and climate change: the value of floodplains along the river Elbe** Alexandra Dehnhardt, Technische Universität Berlin, Germany	**Climate change limits elasmobranch recovery potential in the German Bight: A meta-population approach based on historical distribution data** Heino O. Fock, Wolfgang Nikolaus Probst, Matthias Schaber	**Climate change in Northeast Germany – a risk assessment for ecosystems for nature conservation planning** Nadine Nusko, Philipp Arndt & Vera Luthardt Eberswalde University for Sustainable Development, Eberswalde, Germany

	Academy of Sciences, Moscow, Russia		Thünen-Institute of Sea Fisheries, Hamburg, Germany	
11:00	**National Parks as outdoor laboratories for climate change impact** Helmut Franz & Michael Vogel Berchtesgaden National Park, Berchtesgaden, Germany	**Potential climate change impacts on the habitat availability of floodplain vegetation - a case study from the Rhine River** Eva Mosner, Maria Carambia, Enno Nilson & Peter Horchler Federal Institute of Hydrology, Koblenz, Germany	**The effective factors and evolution of Edremit coastal areas** Ümit Erdem, Şeyma Şengür, Ömer Atabeyoğlu & Nurdan Erdoğan European Ecological Council, Ordu University, Ege University Center of Environmental Problems, Bornova/ İzmir, Turkey	**How can urban brownfields contribute to climate adaptation and human wellbeing in cities?** Juliane Mathey Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany
11:15	**Farming with Alternative Pollinators (FAP) – an indispensable method to protect alpine biodiversity and livelihoods in the course of climate change** Stefanie Christmann, Aden Aw-Hassan, ICARDA,,Tashkent, Uzbekistan		**A strategy and an action plan for the Baltic Sea Region - A tool for reducing the region's vulnerability to climate change** Susanne Altvater, Franziska Stuke & Katrin Kiefer Ecologic Institute, Berlin, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany	**Adapting to Change – How to manage urban ecosystems in a changing climate** Stefan Heiland & Christian Wilke Technische Universität Berlin, Germany
11:30	Discussion	Discussion	Discussion	Discussion
12:30	**Buffet lunch** **Poster Exhibition**			
	Seminar Room A	Seminar Room B	Seminar Room C	Main Lecture Theater
14:30	**Interactive Session: Forest & woodland ecosystems** chair: Marina von Weissenberg, Ministry of Environment, Finland	**Interactive Session: Peatland ecosystems** chair: Rob Stoneman, Director Yorkshire Wildlife Trust, UK	**Interactive Session: Connecting with people – why biodiversity conservation makes sense in a changing climate** chair: Klemens Riha, Programme „Implementing the Biodiversity Convention"; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany	**Interactive Session: Adaptation Planning** chair: Jan Plesnik, Agency for Nature Conservation and Landscape Protection of the Czech Republic

14:30	**Monitoring of Potential Climate-induced Impacts on Woodland Habitats with Earth observation methods** Michael Förster, Tobias Schmidt & Birgit Kleinschmit Technical University of Berlin, Germany	**Restoring Peatlands in Russia – for fire prevention and climate change mitigation: framework for integrative approach to peatland ecosystem management** Andrey Sirin, Hans Joosten, Tatiana Minayeva, Marcel Silvius & Sebastian Schmidt Institute of Forest Science, Russian Academy of Sciences, Russia, Greifswald University, Germany, Wetlands International, The Netherlands, Michael Succow Foundation, Germany	**Prudence, Justice and the Good Life: Ethical foundations of biodiversity communication** Uta Eser, Centre for Economics and the Environment, Nuertingen-Geislingen University, Germany	**A decision framework for considering climate change adaptation in biodiversity conservation planning** Tom H. Oliver, Richard J. Smithers & Kevin Watts Centre for Ecology & Hydrology, Ricardo-AEA Ltd., Forest Research, UK
14:45	**Social learning processes developing local climate change scenarios as a precondition for sustainable reforestation** Stefanie Christmann, Aden Aw-Hassan, ICARDA,,Tashkent, Uzbekistan	**Peatland biodiversity conservation will mitigate climatic change impacts in the European North-East of Russia** S. Zagirova & O. Mikhaylov Institute of biology Komi SC UrB RAS, Syktyvkar, Russia	**Navigating in a sea of risks: MARISCO, a conservation planning method used in risk-robust and ecosystem-based adaptation strategies** Stefan Kreft, Daniela Aschenbrenner, Christoph Nowicki, Steffen Reichle, Lena Strixner, Peter Hobson, Pierre L. Ibisch Eberswalde University for Sustainable Development, Germany, Fundación para la Conservación del Bosque Chiquitano, Santa Cruz, Bolivia, University of Essex, UK	**Legal aspects of connectivity conservation** Barbara Lausche IUCN Environmental Law Centre, Bonn, Germany
15:00	**Climate change induced vegetation shifts in Europe** Ágnes Garamvölgy Corvinus University of Budapest, Hungary	**Exploring resilience concept for fen ecosystems: can we predict long-term effects of current conservation approaches?** Wiktor Kotowski & Ewa Jabłońska	**The role of migratory animals in raising public awareness of the biodiversity-climate change nexus** Johannes Stahl UNEP/CMS Secretariat, UN Campus, Bonn,	**Indicators for climate change impacts on biodiversity - Which suits for which purpose?** Rainer Schliep, Robert Bartz, Rainer Dröschmeister, Frank Dziock, Silvia Dziock,

		University of Warsaw, Centre of Biological and Chemical Research, Poland	Germany	Ingo Kowarik, Laura Radtke, Livia Schäffler, Stefan Siedentop, Christoph Sudfeldt, Ulrich Sukopp, Sven Trautmann &Stefan Heiland Technische Universität Berlin, Federal Agency for Nature Conservation, University of Applied Sciences, Dresden, University of Stuttgart, Federation of German Avifaunists, Münster, Germany
15:15	**Climate Change, Forest dynamics and Consequences for forest management in North Rhine-Westfalia** Norbert Asche, Landesbetrieb Wald und Holz NRW, Germany	**Economic and legal conditions for sustainable peatland management in Germany** Simone Witzel & Theodor Fock University of Applied Sciences Neubrandenburg, Germany	**Eight steps to consistent adaptation across an organisation** Olly Watts Royal Society for the Protection of Birds, Sandy, UK	**Assessing climate change risks and opportunities for species.** James Pearce-Higgins, Malcolm Ausden, Colin Beale, Richard Bradbury, Matthew Carroll, Humphrey Crick, Nick Macgregor, C. McClean, N. Ockendon, Tom Oliver, T. Savage, Chris Thomas British Trust for Ornithology, Royal Society for the Protection of Birds, York Environmental Sustainability Institute, University of York, Natural England, Centre for Ecology and Hydrology, UK
15:30	Discussion	Discussion	Discussion	Discussion
16:30	Tea & coffee		Foyer	
17:00	**Plenum Summary**		Main Lecture Theater	
19:00	**Conference Dinner**		Parkrestaurant Rheinaue, Ludwig-Erhard-Allee 20, 53175 Bonn	

27 June 2013		
9:00	**Introduction and review of day 2** chair: Aletta Bonn, Freie Universität Berlin, Germany	Main Lecture Theater
	Policy and business solutions for conservation under climate change	
9:10	**Keynote: Spatial Planning of Green Infrastructure in a changing climate – Links to EU policy** Rob Jongman, Eveliene Steingröver, Irene Bouwma & Claire Vos, Alterra, Wageningen, The Netherlands	Main Lecture Theater
9:40	**Keynote: TEEB DE: Climate Policy and Nature Conservation – Synergies & Conflicts** Volkmar Hartje, Technische Universität Berlin, Germany	Main Lecture Theater
10:10	**Payments for Ecosystem Services – options for financing adapting natural environments to climate change** Mark Reed, University of Birmingham, UK	Main Lecture Theater
10:30	Tea & coffee	Foyer
11:00	**Water Framework Directive – policy coherence as a key factor for improved water management and nature conservation in a changing climate** Michael Bender, GRÜNE LIGA e.V., Germany	Main Lecture Theater
11:20	**Identifying spatial priorities for adaptation and mitigation action in the Welsh landscape** Clive Walmsley, Countryside Council for Wales, UK	Main Lecture Theater
11:40	**Plenary Discussion – Visions for a climate change adapted European nature conservation** chair: Horst Korn, German Federal Agency for Nature Conservation (BfN)	Main Lecture Theater
12:50	**The way forward and closing of the conference** Beate Jessel, German Federal Agency for Nature Conservation (BfN)	Main Lecture Theater
13:00	**Farewell**	Main Lecture Theater

Annex 4
Programme of Poster Presentations

No.	Titel	Author	Presenter	Affiliation
1.	Remote sensing signals of erosion and plant diversity in the Greater Caucasus, Georgia	Martin Wiesmair, Annette Otte, Dietmar Simmering, Rainer Waldhardt	Martin Wiesmair	Center for International Development and Environmental Research (ZEU), Justus Liebig University, Giessen, Germany
2.	Contribution of Landscape Planning to the protection of biodiversity under conditions of climate change. The example of the Altai mountains	Stefan Heiland, Nina Kocheeva	Nina Kocheeva	Technische Universität Berlin, Fachgebiet Landschaftsplanung und Landschaftsentwicklung,Gorno-Altaisk State University
3.	Canadian method for peatland restoration: lessons learned for Germany?	M.D. Graf	M.D. Graf	Institute for Environmental Planning, Leibniz Universität Hannover, Germany
4.	Climate change adaptation in a biosphere reserve: Trade-offs between nature conservation and other ecosystem services	Stefan Schörghuber, Manfred J. Lexer, Werner Rammer	Stefan Schörghuber	Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna
5.	Reed or salt grassland? Assessment of the ecosystem functions and services of coastal vegetation with respect to climate change and coastal protection at the German Baltic Sea	Anastasia Koch, Jasmin Mantilla-Contreras	Anastasia Koch	Institute of Botany and Landscape Ecology, University of Greifswald, Germany; Ecology and Environmental Education Group, Institute of Biology and Chemistry, University of Hildesheim, Germany
6.	Arctic coastal wetlands resilience to climate change and human impact	L. Sergienko, T. Minayeva, O. Uspeskaya, N. Zaretskaya	L. Sergienko	Petrozavodsk State University,Wetlands International, Institute of Vegetable Crops Russian Academy of Agricultural Sciences, Geological Institute Russian Academy of Sciences
7.	Mind the summit trap? Cold stenothermic fauna in headwaters and its climate change monitoring potential	Martin Reiss, Stefan Zaenker	Martin Reiss	Philipps-Universität Marburg, Department of Geography, Hesse Federation for Cave and Karst Research, Biospeleological Register of Hesse

No.	Titel	Author	Presenter	Affiliation
8.	High elevated Peatlands in Mongolia – most vunerable grasslands under climate change in central Asia	Sirin A., Minayeva T., Gunin P., Dugardjav Ch., Bazha S., Bayasgalan D., Dorofeyuk N., Uspenskaya O.	Sirin A.	Institute of Forest Science Russian Academy of Sciences, Wetlands International, the Netherlands, Severtsov Institute of Ecology and Evolution Russian Academy of Sciences, Botanical Institute Mongolian Academy of Sciences, Severtsov Institute of Ecology and Evolution Russian Academy of Sciences, Botanical Institute Mongolian Academy of Sciences, Severtsov Institute of Ecology and Evolution Russian Academy of Sciences, Institute of Vegetable Crops Russian Academy of Agricultural Sciences
9.	Collective action and seed isles in common rangelands as a joint climate adaptation strategy	Stefanie Christmann, Aden Aw-Hassan	Stefanie Christmann	Environmental Governance, ICARDA; Director SEPRP, ICARDA-Headquarter
10.	Cultivation model development for woody plants in semi-arid climatic zones	Areg Karapetyan	Areg Karapetyan	"Hayantar" SNCO
11.	Planning instruments towards Urban Biosphere	Benedetto Nastasi	Benedetto Nastasi	Department DATA, Sapienza University of Rome
12.	Effects of extreme meteorological conditions on reproductive success in a temperate-breeding songbird	Ivett Pipoly, Veronika Bókony, Gábor Seress, Krisztián Szabó, András Liker	Ivett Pipoly	University of Pannonia, Department of Limnology, Veszprém, Hungary, University, Department of Ecology, Budapest, Hungary. University of Sheffield, Department of Animal and Plant Sciences, Sheffield, UK
13.	Planning for Change – How to adapt protected area management	Christian Wilke, Sven Rannow	Sven Rannow	Technische Universität Berlin, Fachgebiet Landschaftsplanung und Landschaftsentwicklung; Leibniz Institute of Ecological Urban and Regional Development

No.	Titel	Author	Presenter	Affiliation
14.	Present and Historical Climate Variability in West England and its Impact on Vegetation Change	A. (Sasha) Kosanic, S. Harrison, K. Anderson	Aleksandra (Sasha) Kosanic	University of Exeter
15.	Engaging conservation managers towards effective adaptation	Simon Duffield, Mike Morecroft, Andy Neale and Olly Watts	Olly Watts	Natural England, RSPB
16.	Using the concept of ecosystem services to a better understanding of nature in the public: A case study in the German state Hessen	Jan Volland, Rüdiger Schaldach	Jan Volland	Center for Environmental Systems Research, University of Kassel
17.	Spotlights on risks and policy options for Germany's protected areas under climate change	K. Vohland, S. Kreft, F.-W.Badeck, K. Böhning-Gaese, W. Cramer, J. Hanspach, P.L. Ibisch, S. Klotz, I. Kühn & S. Trautmann	Stefan Kreft	Potsdam Institute for Climate Impact Research, Natural History Museum, Leibniz Institute for Evolutionary and Biodiversity Research at the Humboldt University Berlin (MfN), Centre for Econics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development (Univ. of Appl. Sc.); Johannes Gutenberg University, Institute of Zoology; Biodiversity and Climate Research Centre (BiK-F); Helmholtz Centre for Environmental Research – UFZ, Department of Community 19Ecology; Leuphana University Lüneburg, Institute of Ecology
18.	Implementation of innovative management techniques by operators of high-voltage network: “Creating green corridors under overhead lines” (LIFE+ Biodiversity)	Jean-François Godeau	Jean-François Godeau	LIFE ELIA

No.	Titel	Author	Presenter	Affiliation
19.	Biodiversity of Decapod Crustaceans in the Southern North Sea Changes in Space and Time	Moritz Sonnewald, Michael Türkay	Moritz Sonnewald	Senckenberg Forschungsinstitut und Naturmuseum Frankfurt
20.	Future-proofing the Somerset Levels: A Need for Information and Innovation	Mark Steer, Francesca Tremlett, Stephen Dury & David Leach	Stephen Dury	Somerset Wildlife Trust; University of the West of England; Somerset County Council
21.	High resistance of Eastern Mediterranean vegetation to climate change in a long-term experimental and theoretical study	Johannes Metz, Wolfgang Siewert, Mark Bilton, Sara Tomiolo, Katja Tielbörger	Sara Tomiolo	Tübingen University, Department of Plant Ecology, Institute for Ecology and Evolution
22.	Simulation of natural reforestation after windthrow – subproject of the Virtual Forest NRW	Silvana Siehoff, Tido Strauss, Gottfried Lennartz	Silvana Siehoff	Research Institute for Ecosystem Analysis and Assessment (gaiac), RWTH Aachen University, Germany
23.	Implications of Climate Change for FFH-Forest Habitat Types	Nico Frischbier, Nils Feske	Nico Frischbier	Service and Competence Center THÜRINGENFORST
24.	The European Climate Adaptation Platform (Climate – ADAPT) – what it can do for you	Nikki Kent	Nikki Kent	Ricardo-AEA
25.	Impacts of temperature and kind of arable land use on the floristic species diversity in European cereal growing areas	Nils Hempelmann, Jörg Hoffmann, Michael Glemnitz, Laszlo Radics und Gyula Czimber†	Nils Hempelmann	Climate Service Center, Julius Kuehne Institut, Leibniz-Zentrum für Agrarlandschaftsforschung, Universität Budapest, Universität Mosonmagyarovar
26.	"GreenNet - Promoting the ecological network of the European Green Belt"	Ilke Marschall, Matthias Gather, Marion Müller	nn	Institut Verkehr und Raum Fachhochschule Erfurt
27.	“The influence of different mowing concepts on true bugs (heteropterans) of urban areas in Tübingen”	Philipp Unterweger, Oliver Betz	Philipp Unterweger	Universität Tübingen, Institut für Evolution und Ökologie Evolutionsbiologie der Invertebraten
28.	Green roofs: an environmental tool for the Mediterranean city	Riguccio L., Tomaselli G.	Riguccio L.,	University of Catania, Italy. DiGeSa (Department of Agri-food and Environmental Systems Management)

No.	Titel	Author	Presenter	Affiliation
29.	Intervention Methodologies to Enhance Sicilian Rural Coastline Landscape Within Climate Change	Riguccio L., Russo P., Carullo L., Tomaselli G.	Riguccio L.,	University of Catania, Italy. DiGeSa (Department of Agri-food and Environmental Systems Management)
30.	Biodiversity criteria for Germany's International Climate Initiative	Robert Munroe, Alana Williamson, Rebecca Mant, Lennart Kuemper-Schlake, Christian Großheim	Christian Großheim	UNEP World Conservation Monitoring Centre, UK; Federal Agency for Nature Conservation, Germany

Annex 5
List of Registered Participants

Surname	Name	Institution	Country
Altvater	Susanne	Ecologic Institute GmbH	Germany
Asche	Norbert	Wald und Holz NRW	Germany
Aufderheide	Ulrike	CALLUNA - naturnahe Garten+GrünPlanung	Germany
Báldi	András	MTA Centre for Ecological Research	Hungary
Beinert	Mira	Biodiv-Concept	Germany
Bell	Christina	Scottish Natural Heritage	United Kingdom
Beltram	Gordana	Park Skocjanske jame	Slovenia
Bender	Michael	GRÜNE LIGA e.V.	Germany
Berdel	Franka	ICON-INSTITUTE Private Sector GmbH	Germany
Bockmühl	Kathrin	German Federal Agency for Nature Conservation (BfN)	Germany
Böhning-Gaese	Katrin	Biodiversity and Climate Research Centre, Frankfurt	Germany
Bonn	Aletta	Freie Universität Berlin, Helmholtz Centre for Environmental Research – UFZ	Germany
Braun	Daniela	Dienstleistungszentrum Ländlicher Raum Mosel	Germany
Carius	Florian	German Federal Agency for Nature Conservation (BfN)	Germany
Christmann	Stefanie	ICARDA (CGIAR-center) (BMU-employee on leave)	Uzbekistan
Davis	McKenna	Ecologic Institute	Germany
De Mars	Hans	Royal HaskoningDHV	The Netherlands
Dehnhardt	Alexandra	TU Berlin, Environmental and Land Economics	Germany
Dodt	Gesa	GIZ	Germany

Surname	Name	Institution	Country
Drexler	Winfried	Bayerische Landesanstalt für Wald und Forstwirtschaft (BfN)	Germany
Duffield	Simon	Natural England	United Kingdom
Dury	Stephen	Somerset County Council	United Kingdom
Ellwanger	Götz	German Federal Agency for Nature Conservation	Germany
Eser	Uta	Nuertingen-Geislingen University	Germany
Essl	Franz	Environment Agency Austria	Austria
Fischer	Adeline	UNEP/ CMS	Germany
Fischer	Wiltrud	Project Management Agency Part of the German Aerospace Center Environment, Culture, Sustainability	Germany
Fock	Heino	Thünen-Institut of Sea Fisheries	Germany
Förster	Michael	TU Berlin	Germany
Franz	Helmut	Berchtesgaden National Park	Germany
Frischbier	Nico	Thüringen Forst-AöR Service und Kompetenzzentrum	Germany
Fröhlich	Jannes	WWF Deutschland	Germany
Garamvölgyi	Ágnes	Corvinus University of Budapest	Hungary
Godeau	Jean-Francois	Solon asbl (LIFE+ Biodiversity 'ELIA')	Belgium
Graf	Martha	Institut für Umweltplanung	Germany
Grassl	Hartmut	Max Planck Institute for Meteorology	Germany
Gregory	Amanda	Joint Nature Conservation Committee	United Kingdom
Greszler	Szilárd	Independent Planet Saver	Hungary
Großheim	Christian	German Federal Agency for Nature Conservation (BfN)	Germany

Surname	Name	Institution	Country
Haller	Inga	EUCC - The Coastal Union Germany	Germany
Haasler	Berthold	Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the German State of North Rhine - Westphalia	Germany
Hartje	Volkmar	Technische Universität Berlin	Germany
Hedden-Dunkhorst	Bettina	German Federal Agency for Nature Conservation (BfN)	Germany
Heiland	Stefan	TU Berlin	Germany
Hempelmann	Nils	Climate Service Center	Germany
Hertenweg	Kelly	Federal Public Service Health, Food Chain Safety and Environment	Belgium
Holtkämper	Volker	Landesbetrieb Wald und Holz NRW	Germany
Horchler	Peter	Federal Institute of Hydrology / Bundesanstalt für Gewässerkunde	Germany
Jabłońska	Ewa	University of Warsaw, Department of Plant Ecology and Environmental Conservation	Poland
Jaeschke	Anja	University of Bayreuth	Germany
Jedicke	Eckhard	Consulting and project development for nature conservation	Germany
Jessel	Beate	German Federal Agency for Nature Conservation (BfN)	Germany
Jongman	Rob	Wageningen UR	The Netherlands
Kachelriess	Daniel	UNEP/CMS Secretariat	Germany
Kaphengst	Timo	Ecologic Institute	Germany
Karapetyan	Areg	Hayantar SNCO, Armenia	Armenia
Karpowicz	Zbigniew	RSPB	United Kingdom

Surname	Name	Institution	Country
Kent	Nikki	Ricardo-AEA	United Kingdom
Khrycheva	Polina	Helmholtz-Centre for Environmental Research	Germany
Klingenstein	Frank	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany	Germany
Koch	Anastasia	University of Greifswald	Germany
Kocheeva	Nina	Gorno-Altaisk State University	Russia
Korn	Horst	German Federal Agency for Nature Conservation (BfN	Germany
Körner	Christian	University of Basel, Institute of Botany	Switzerland
Kosanic	Sasha	University of Exeter	United Kingdom
Kotowski	Wiktor	University of Warsaw	Poland
Kowarik	Ingo	Technische Universität Berlin	Germany
Kreft	Stefan	Centre for Econics and Ecosystem Management, Eberswalde University for Sustainable Development (Univ. Appl. Sc.)	Germany
Kruess	Andreas	German Federal Agency for Nature Conservation (BfN)	Germany
Kümper-Schlake	Lennart	German Federal Agency for Nature Conservation (BfN)	Germany
Kunze	Kerstin	Hanseatische Naturentwicklung GmbH	Germany
Laamanen	Maria	HELCOM	Finland
Lausche	Barbara	IUCN World Commission on Environmental Law	Germany
Lennartz	Gottfried	Research Institute for Ecosystem Analysis and Assessment (gaiac), RWTH Aachen University, Germany	Germany

Surname	Name	Institution	Country
Lilienthal	Metke	Stiftung Natur und Umwelt RLP	Germany
Loft	Lasse	Biodiversität und Klima Forschungszentrum	Germany
Lucas	Sarah	IUCN Environmental Law Centre	Germany
Macgregor	Nicholas	Natural England	United Kingdom
Mantle	Gary	Wiltshire Wildlife Trust	United Kingdom
Marusczyk	Julia	Hessisches Landesamt für Umwelt und Geologie	Germany
Mathey	Juliane	Leibniz Institute of Ecological Urban and Regional Development	Germany
Mayr	Claus	NABU, c/o BirdLife Europe	Belgium
McGlade	Jacqueline	formerly EEA	Denmark
Mertens	Cordula	Institute of Environmental and Landscape Management, St. István University Gödöllö	Hungary
Minayeva	Tatiana	Wetlands International	The Netherlands
Mohren	Frits	Wageningen University	Netherlands
Morecroft	Mike	Natural England	United Kingdom
Mosner	Eva	Federal Institute of Hydrology	Germany
Mues	Andreas Wilhelm	Bundesamt für Naturschutz	Germany
Nauber	Jürgen	German Federal Agency for Nature Conservation (BfN)	Germany
Neukirchen	Cornelia	German Federal Ministry of Environment (BMU)	Germany
Nusko	Nadine	Eberswalde University for Sustainable Development	Germany
O'Briain	Micheal	European Commission - Directorate General for Environment	Belgium

Surname	Name	Institution	Country
Oliver	Tom	Centre for Ecology and Hydrology	United Kingdom
Origer	Claude	Ministry for Sustainable Development Luxembourg	Luxembourg
Pearce-Higgins	James	British Trust for Ornithology	United Kingdom
Pipoly	Ivett Ildikó	University of Pannonia	Hungary
Plesnik	Jan	Nature Conservation Agency of the Czech Republic	Czech Republic
Poláková	Jana	IEEP	Belgium
Preuss	Stefanie	--	Germany
Rannow	Sven	Leibniz Institute of Ecological Urban and Regional Development	Germany
Reed	Mark	Birmingham City University	United Kingdom
Reich	Michael	Leibniz Universität Hannover – Umweltplanung	Germany
Reiss	Martin	Philipps-Universität Marburg, FB Geographie	Germany
Riha	Klemens	GIZ	Germany
Sara	Gianluca	University of Palermo	Italy
Sarbu	Anca	University of Bucharest	Romania
Schäffler	Livia	Institut für Raumordnung und Entwicklungsplanung, Universität Stuttgart (IREUS)	Germany
Schell	Christiane	German Federal Agency for Nature Conservation	Germany
Schleupner	Christine	Bundesanstalt für Immobilienaufgaben	Germany
Schliep	Rainer	Technische Universität Berlin	Germany
Schmalzbauer	Bettina	German Committee Future Earth (c/o GEOMAR)	Germany
Schmidt	Jenny	Helmholtz-Zentrum für Umweltforschung (UFZ), Leipzig	Germany

Surname	Name	Institution	Country
Schörghuber	Stefan	Institute of Silviculture, BOKU - University of Natural Resources and Life Sciences, Vienna	Austria
Schröder	Boris	TU München	Germany
Sergienko	Liudmila	Petrozavodsk State University	Russian Federation
Siehoff	Silvana	Research Institute for Ecosystem Analysis and Assessment (gaiac), RWTH Aachen University	Germany
Sonnewald	Moritz	Senckenberg Forschungsinstitut und Naturmuseum	Germany
Specht	Rudolf	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany	Germany
Spielmann	Sigrid	Fachhochschule Bingen	Germany
Stadler	Jutta	German Federal Agency for Nature Conservation	Germany
Stahl	Johannes	Secretariat of the Convention on Migratory Species (CMS)	Germany
Steimann	Meike	Landesbetrieb Wald und Holz NRW	Germany
Stein	Roland	Pfälzerwald - Vosges du Nord Biosphere Reserve, Verein Naturpark Pfälzerwald, e.V.	Germany
Stoneman	Rob	Yorkshire Wildlife Trust	United Kingdom
Svärd	Lena	Swedish Environmental Protection Agency	Sweden
Tanneberger	Franziska	University of Greifswald	Germany
Thomas	Chris	University of York (Dept of Biology)	United Kingdom
Tockner	Klement	Leibniz-Institut für Gewässer-ökologie und Binnenfischerei	Germany
Tomiolo	Sara	University of Tübingen	Germany

Surname	Name	Institution	Country
Tunkala	Bereket Zeleke	Bonn University	Germany
Tydecks	Laura	Leibniz-Verbund Biodiversität	Germany
Unterweger	Philipp	Universität Tübingen	Germany
van der Hoek	Dirk-Jan	PBL Netherlands Environmental Assessment Agency	The Netherlands
Vasama	Arja	Metsähallitus, Natural Heritage Services	Finland
Vaziri Zanjani	Leila	Greifswald University	Germany
Vegh	Lea	WWF Floodplain Institute	Germany
Volland	Jan	Center for Environmental Systems Research	Germany
von Weissenberg	Marina	Ministry of the Environment	Finland
Walmsley	Clive	Natural Resources Wales	United Kingdom
Walther	Gian-Reto	Federal Office for the Environment (FOEN)	Switzerland
Wangombe	Mary Wanjiku	University of Bonn	Germany
Watts	Olly	RSPB	United Kingdom
Wiemers	Martin	Helmholtz Centre for Environmental Research - UFZ	Germany
Wiesmair	Martin	Universität Gießen, ZEU	Germany
Winkel	Georg	University of Freiburg, Forest and Environmental Policy Working Group	Germany
Witzel	Simone	University of Applied Sciences Neubrandenburg	Germany
Zagirova	Svetlana	Institute Biology of Komi Science Centre	Russia
Zaunberger	Karin	European Commission	Belgium