SCIENCE FOR THE CARPATHIANS

Strategy Development and Networking Workshop

Jagiellonian University, Kraków, Poland - May 27-28, 2008

Workshop Report

Published by the Mountain Research Initiative (MRI)
c/o Institute of Geography, University of Berne
Erlachstrasse 9a, Trakt 3, 3012 Bern, Switzerland
Phone: +41 (0)31 631 51 41
Email: mri@giub.unibe.ch
Webpage: http://www.mri.scnatweb.ch

Hard copies can be ordered at the MRI office email: mri@giub.unibe.ch; phone: +41 (0)31 631 51 41

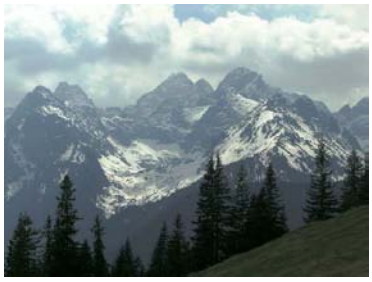
Science for the Carpathians

S4C

Strategy Development and Networking Workshop
27-28 May 2008, Kraków, Poland

Workshop Report



Programme Committee:

Astrid Björnsen Gurung, Mountain Research Initiative, Berne, Switzerland
Manuela Hirschmugl, Joanneum Research, Graz, Austria
Patrick Hostert, Geomatics Lab, Geography Department, Humboldt-Universität zu Berlin, Germany
Pierre Ibisch, Lars Schmidt, Faculty of Forest and Environment, University of Applied Sciences Eberswalde, Germany
Jacek Kozak, Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
Marc Zebisch, The European Academy, Bolzano, Italy

Local Organising Committee:

Katarzyna Ostapowicz, Anna Szukalska, Joanna Depta, Dominik Kaim, Natalia Kolecka, Andrzej Kotarba, Izabela Sitko, Mateusz Troll, Bartosz Zaluski
Department of GIS, Cartography and Remote Sensing, Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland

The workshop was organized with support of:

Mountain Research Initiative, Berne, Switzerland
UNEP, Interim Secretariat of the Carpathian Convention, Vienna, Austria
European Academy, Bolzano, Italy
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland

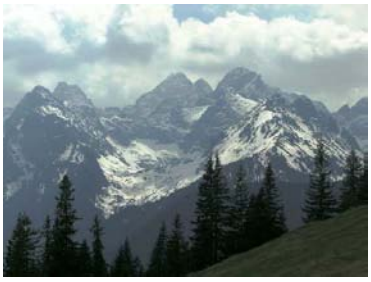
Workshop Report:

Katarzyna Ostapowicz, Izabela Sitko (eds.)
Contributing authors: **Astrid Björnsen Gurung**, **Marine Elbakidze, Manuela Hirschmugl**, **Pierre Ibisch, Jacek Kozak, Elena Matei, Katarzyna Ostapowicz, Joanna Pociask-Karteczka, Izabela Sitko, Marc Zebisch**
Front page: **Anna & Maciej Szukalscy**
Photos: **Natalia Kolecka** (p. 3, 20), **Andrzej Kotarba** (p. 14), **Jacek Kozak** (p. 1, 2, 31, 37, 43), **Katarzyna Ostapowicz** (p. 25), **Mateusz Troll** (p. 6, 18, 21, 26, 34, 41), **Bartosz Załuski** (p. 4, 8-15, 27)

Bern, Switzerland 2009

ISBN 978-83-88424-40-3



Contents

Preface.....4

The Carpathians.....6

Background and objectives.....7

Results of working groups discussion.....8

Final results.....14

Presentations.....15

Posters.....27

Appendix:

I. List of participants.....39

II. Workshop program.....42

The Romanian Carpathians

Preface

„To climb steep hills requires slow pace first". Although Shakespeare's quote does not refer to the recent evolvement of the Science for the Carpathians (S4C) initiative, it applies to the science network with roots going back to 2001. That time, the Ukrainian Government requested the United Nations Environment Programme (UNEP) to facilitate a process similar to that of the Convention on the Protection of the Alps (Alpine Convention). The UNEP forwarded the request to the Italian Ministry for the Environment and Protection of Territory as the Italian Government demonstrated a vivid interest in promoting sustainable development in mountain areas after the Johannesburg Summit 2002. At that time, Italy held the presidency of the Alpine Convention and the European Academy (EURAC) in Bolzano hosted the permanent Alpine Convention Secretariat. Together with UNEP and the financial support of Italy, EURAC hosted a first meeting in Bolzano with representatives from the Alpine Convention. Subsequent meetings occurred in Vaduz, Vienna and Bolzano.

Upon acceptance of the Carpathian Convention in Kiev (23 May 2003) the Italian Ministry for the Environment and Protection of Territory committed to continued support of the operation of the Convention and the development of the specific implementation projects.

Figure 1. History of the Science for the Carpathians (S4C) initiative.

EURAC played a central role in the framing of scientific issues related to the Convention. The first Ad Hoc Expert Meeting of the Carpathian Convention in Bolzano in May 2004 welcomed the scientific support activities offered by EURAC and recommended stronger cooperation between the Carpathian Convention's Interim Secretariat at UNEP in Vienna and EURAC. In October 2004, the two parties signed a Memorandum of Cooperation, including scientific, logistical and communication support. Consequently, EURAC hosted expert meetings and the preparatory meeting for the Conference of the Parties of the Carpathian Convention scheduled for 2006. EURAC was also central in the development of numerous reports.

The INTERREG CADSES "Carpathian project" was an important stimulant for the creation of the Carpathian science initiative, as it clearly showed the necessity of

Participants of the S4C workshop

organizing science in the region. Initiated by ISCAR and the Secretariat of the Carpathian Convention, a small group of scientists and stakeholders met at the Forum Alpinum 2007 in Engelberg, Switzerland, to develop initial ideas for a science network in the Carpathians similar to the one existing in the Alps. One important goal of the network is to unite and use efficiently a huge research potential which has existed for many years in all countries of the Carpathian region. The preliminary ideas were further elaborated during a consecutive meeting in Bolzano in October 2007. At this stage, the group coined the name "Science for the Carpathians" (S4C).

Hence, it took a long breath, until 2008, for the idea to take shape and the climb to start. A climb towards a network of active scientists with an interest in developing Carpathian mountain science. The crucial impetus was given with the launch of the „Science in the Carpathians – Strategy Development and Networking Workshop" (27-28 May 2008, Kraków, Poland) setting the first milestone. The workshop was organized by the Institute of Geography and Spatial Managment Jagiellonian University (Kraków), EURAC (Bolzano), Joanneum Research (Graz), The University of Applied Sciences Eberswalde, Humboldt Universität zu Berlin, and the MRI (Berne).

The Carpathians

The Carpathians are middle mountains in the heart of the Central Europe. Although various regional divisions delineate in different ways the boundary of the Carpathians, it is agreed that the Carpathian countries are the Czech Republic, Hungary, Poland, Romania, Slovakia and Ukraine; in addition Austria and Serbia are frequently included. The region holds tributaries of four European watersheds: Danube, Vistula, Oder and Dnister. Due to relatively low elevations which only in few ranges exceed 2500 m asl the mountains are not glaciated, however in several regions they exhibit a distinct alpine character.

Since the Middle Ages most of the Carpathian region was controlled by Hungary and Poland. Later, its southern and eastern parts came under the influence of the growing Ottoman Empire. These powers were declining in the next centuries, and in the end of the 18th century most of the region was incorporated into the Austrian Empire. Except for the formation of the independent Romania in the end of the 19th century, the Austrian (later on Austro-Hungarian) domination was continued until the World War I. After the World War I the Carpathians were divided among several independent states: Czechoslovakia, Poland, Hungary and Romania. They later experienced
the turmoil of the World War II and the expansion of the Soviet Union. The collapse of the Soviet Union after almost 50 years of communism in the region led to the emergence of the independent Ukraine later on, the split of Czechoslovakia (Czech Republic and Slovakia, 1993) and

Ukrainian Carpathians

Tatra Mountains

Yugoslavia (emergence of Serbia) constituted final acts of political changes in the Carpathians. Political transformation initiated in the late 1980s led to profound changes in the post-communist societies and economy. All countries of the region defined the political and economical integration with Europe as their most important goal, and except for Ukraine and Serbia, all Carpathian countries became members of the European Union (Czech Republic, Hungary, Poland and Slovakia in 2004, Romania in 2007).

Why Carpathians?

The Carpathians are an important region for European biodiversity. The mountains still contain valuable semi-natural and primeval areas, show a wealth of forests, and have a great variety of plants and animals, with the richest community of large mammals in Europe. The mountains are also a 'water tower' of the Central and Eastern Europe. The region has a major significance for the tourism industry, both at the national and international scale. Several industrial regions related mostly to mining activities and timber exploitation are scattered along the Carpathian chain.
A complexity of the recent history, co-existence of areas of rapid development and traditional landscapes, together with conflicts of interests between nature conservation and needs of tourism, industry or transportation, make the Carpathians particularly interesting to science especially in the light of sustainable development in the region.

Background and objectives

The Science for the Carpathians workshop was held at the Institute of Geography and Spatial Management of Jagiellonian University, Kraków from 28th to 29th of May 2008.

The meeting targeted at:

- defining the current status of Global Change research in the Carpathian mountains in specific disciplines;
- drafting a research strategy for the Carpathians focusing on topics relevant to the region;
- identifying potential partners for jointly developing research proposals and projects on Global Change impacts in the Carpathian mountains;
- establishing an active S4C network.

The workshop was designed to achieve active interaction and communication between participants. A total of 67 participants, mostly from the Carpathian countries (Fig. 3), contributed to the formulation of a research strategy for the Carpathians . The knowledge on "who's who" was a prerequisite for the development of international research cooperation, for new research initiatives and the identification of national and international research partners. The "S4C Market" for instance, offered such a platform as an open area in which every person or organization could display research results (mostly as poster and short oral presentations), experiences, methods and approaches that work (or don't work). Of equal importance was the question of "what needs to be done?". For this purpose, the participants contributed to the larger picture of the current research status in the Carpathians leading to the development of the Carpathian research strategy taking the GLOCHAMORE Research Strategy (http://mri.scnatweb.ch/projects/glochamore) as a departure point. After the identification of resources and gaps, new and meaningful research initiatives are envisaged to develop within the frame of the S4C network.

The participants had as well the possibility to pursue their field of interest by taking part in a working group (WG). WG aimed at developing the research strategy for the Carpathians in a specific field or discipline. The workshop participants set the basis by defining research themes:

WG1: Forest and land use change (chairs: J. Kozak, B. Zagajewski)

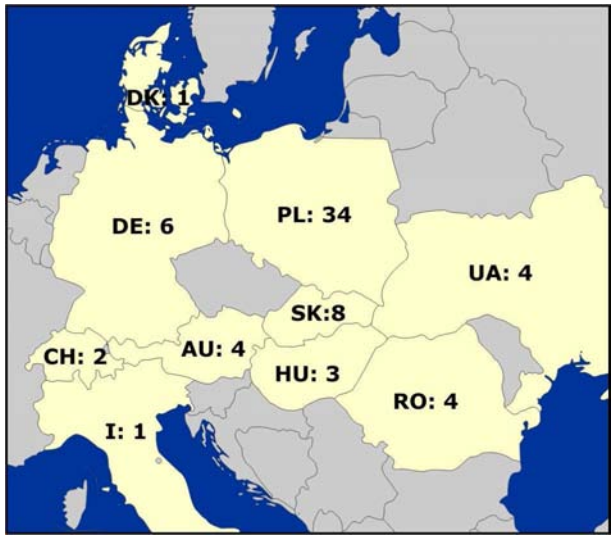
WG2: Climate change and biodiversity conservation (chairs: P. Ibisch, W. Mróz)

WG3: Carpathian tourism network (chair: E. Matei)

WG4: Ecosystem services & human wellbeing (chair: M. Elbakidze)

WG5: Carpathian Waters (chairs: W. Chełmicki, J. Pociask-Karteczka)

Figure 3. Where do we come from?



Results of working groups disscusion

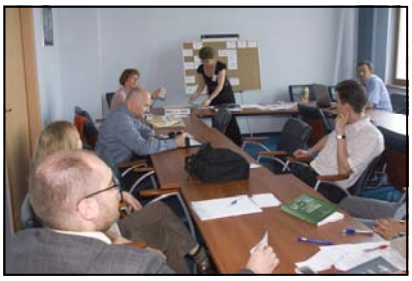
WG1: Forest and Land Use Change

The research issues roughly delineated: land use and land cover change modelling, multi-disciplinary studies, mapping of land use, land cover and change, methodological and data issues. Several issues specific for forestry (potential threats, harmful impacts of anthropogenic and biotic factors, inventories of forest productivity and its projections in relation to carbon sequestration) were outlined as well.

WG2: Climate change and biodiversity conservation

Currently observed threats to biodiversity are more related to land use changes than climate change. However, there is a number of observed or expected impacts of climate change on biodiversity on all hierarchical levels as well as on natural resources. An effective, cross-boundary information management is seen as a crucial element of any strategy dealing with biodiversity under global change.

WG3: Carpathian tourism network



Carpathians tourism can function in each country according to national strategies, but global changes will affect all in the same way. To cope with these challenges it is necessary to unify efforts for sustainable regional development, protection of natural heritage and cultural values. To meet the tourists' interests it is important to integrate tourism into mountain economy and to promote educational aspects of tourism.

WG4: Ecosystem services and human wellbeing

Assessments of ecosystem services require estimates of changes in ecosystem processes and structures and in the resulting levels of services. As a conclusion, there is an urgent need to develop an *ecosystem services approach* in the Carpathian ecoregion due to many radical changes in political, social and ecological environments in all countries in the ecoregion at present time.

WG5: Carpathian Waters

Recent and potential research topics in water science were identified: land use change impact on water quality, identification of resources and ecological services, inventory of wetlands, snowpack studies, extreme hydrological events, hydrochemical balance of catchments, identification of suitable farming practices for correct water management, development of change scenarios of water balance elements in response to climate change.

WG1: Forest and land use change

'The Forest and land use change' working group attracted 17 participants (Austria, Germany, Hungary, Poland, Slovakia, Ukraine).

First, important topics were listed by participants during a brain-storming session. These covered a broad spectrum of issues related to land use and forestry. Next, these topics were interactively grouped and discussed in order to outline the research needs and priorities. Following research issues were roughly delineated (with a number of overlapping areas):

1. Land use and land cover change (LUCC) modelling
2. Multi-disciplinary studies
3. Mapping of land use, land cover and change
4. Methodological and data issues
5. Specific forestry issues

As for 1, it is important to link LUCC to driving forces and socio-economic impacts, and to integrate efforts of dispersed and isolated science communities. In addition, development of spatially explicit scenarios for the Carpathian area was found to be still at the preliminary stage.

In 2, various external links of LUCC and forestry research were listed, e.g. landscape/ecosystem studies and nature conservation. The importance of climate change for land cover and land use studies was accepted, in particular as it has a major significance for Carpathian forestry, due to a number of potential impacts and increasing frequency of natural disasters. Changing environmental and socio-economical conditions require improved forest management and alteration of priorities – from timber production to multi-functional forestry, responding to various needs and demands of society (e.g., recreation areas, provision of high quality water resources).

Under point 3, important types of land cover and land use changes and transitions were listed (e.g., urban sprawl, land abandonment, forest change) together with theoretical issues related to mapping at the pan-Carpathian scale (harmonisation of definitions, standardisation of inventories).

The latter are important from the methodological point view (4), together with harmonisation of case study methodologies, planning case study networks and sampling designs at different scales which should facilitate meta-analysis of results and synthetical approaches. Among data issues, the need to preserve the cartographic legacy of the Austro-Hungarian empire was emphasized, as an important resource for long-term studies (>100 years). Lack of consistent data policies was identified to as an important problem in the pan-Carpathian studies. In EU countries (Czech Republic, Hungary, Poland, Romania and Slovakia) provision of reliable data (including spatial data) is ensured or will be secured in future, e.g. by the development of the European Spatial Data Infrastructure. It is essential that data of comparable quality are also available for the Ukrainian and Serbian parts of the Carpathian mountains. A good example of this problem is the CORINE Land Cover programme, with data available for Carpathian EU countries, while missing the Ukraine and Serbia. Extension of European spatial data sets, and in particular CORINE, was declared as necessary to ensure a consistent land cover mapping of the Carpathian area at a coarse spatial resolution.

Several issues specific for forestry were discussed (5), including a listing of potential threats to Carpathian forests, and harmful impacts of anthropogenic and biotic factors. Inventories of forest productivity and its projections were considered important for the assessment of carbon sequestration.

WG2: Climate change and biodiversity conservation

After a introductory round of the 17 participants the group went into a first rough analysis of problems, knowledge gaps and potential research questions. It was stated that climate and climate change in the Carpathians are insufficiently known. Needs for both, basic information, such as climatological maps, and applied studies, such as the potential economic consequences of climate change in the Carpathians were addressed.

Currently observed threats to biodiversity are rather attributed to land use change than climate change. However, the participants listed a number of observed or expected impacts of climate change on biodiversity on all hierarchical levels (especially on species and ecosystems) as well as on natural resources. Some of the research questions mentioned referred to the changes of the distribution of species (including invasive), the seminatural landscapes, the changes of the vertical zones, and the tree and forest-line ecology. The relevance of extreme events for short-term impacts was stressed. Initiatives of adaptation to and mitigation of climate change can indirectly trigger new or enhance existing threats.

An effective, cross-boundary information management is seen as a crucial element of any strategy dealing with biodiversity under global change. Among others, this includes species inventories, mapping efforts, and (early warning) monitoring.

The needs and options for adaptation of biodiversity conservation to global (environmental) / climate change have to be explored. The group stressed the importance of policy and management related to protected areas (e.g., pan-Carpathian forest reserve network), including an enhanced involvement of stakeholders. The scientific basis of the Natura 2000 approach might require further development. Some general questions were discussed ("Can you conserve [under] change?") concluding that it is challenging to factor in environmental change in a dynamic conservation management. In this context , participants highlighted the importance of landscape or ecosystem approaches to conservation. The relevance of climate change / global change to Carpathian biodiversity question was not unanimously recognized by all participants. Hence, there should be a variety of opinions for the manifold stakeholders, conservation practitioners and scientists in the region.

Following the main thematic lines of the problem anaylsis, the group drafted first proposals for a research strategy:

1. Acquire an adequate knowledge of Carpathian biodiversity (including main stakeholders);
2. Understand the consequences of global change impacts on Carpathian biodiversity and its services (taking into account regional variation, fostering common standards and maybe focussing on selected sites/ ecosystems);
3. Improve transfer of information (data flow, dissemination, access);
4. Understand the past impacts and threats, as well as the current and future drivers of threats;
5. Develop and practice effective biodiversity management strategies that take adequately into account global change and corresponding (future) impacts.

A practical recommendation was that the 2nd European Congress of Conservation Biology ("Conservation biology and beyond: from science to practice") at the Czech University of Life Sciences, Prague, September 01 – 05, 2009, could be used as a forum to further cooperation and research about Carpathian biodiversity and its conservation.

WG3: Carpathian tourism network

The Carpathians lie in seven countries, but this workshop debate has united only three of them: Romania, Poland and Ukraine, the holders of the largest mountainous areas. The activity could be considered as a process of knowing "who is who" and what was done in research projects. This workshop established the necessary contects and knowledge about existing resources as a perquisite for taking the next steps for an international collaboration for Carpathians.

The aim of the working group was to establish joint interests in research, to identify differences and to sketch out future needs.

In the past years all three countries were involved in projects related to health tourism, spas and potential of tourism, protected areas and tourism, the environmental impact of tourism and changes in tourism after 1989. But there are differences: while Poland has profoundly analyzed trans-boundary tourism or spatial planning and the Ukraine agro-tourism and ecotourism, Romania studied the preservation of traditions and rural tourism.

For all three countries the following gaps were identified: sustainable tourism development, management of tourist infrastructure, and social processes in trans-boundary areas.

Rationale:

The setting up of a strong tourism network composed by experts within Carpathians countries' universities and research institutes supporting innovation in tourism will facilitate the transfer of knowledge from academia to industry.

Carpathian tourism can function in each country following national strategies. However global change will affect them in the similar way. To cope with these challenges it is necessary to unify efforts for sustainable regional development, protection of natural heritage but also preserving cultural values, meeting the tourists' interests, integration of tourism in mountain economy, promoting educational aspects of tourism and spreading the best tourism practices.

It also requires joint research protocols, an inventory of existing scientific knowledge, identification of knowledge gaps within priorities, an information exchange with stakeholders, joint research, sharing and communicating best products and practices, and a permanent enhancement of the network.

Conclusions:

The Carpathians countries share a unique mountain chain but face several difficulties concerning language, development politics, financial support, grants, etc. The tourism network runs at the national level, but at the international level it is based on professional relationships, thus it needs more steps and volition to extend it. A common project could be a good entrance, but in many cases countries belong to two or more regional financial schemes. The Central Europe Program for instance includes Poland, Slovakia, Czech Republic and Hungary while Romania and Serbia belong to the South East Europe Program and the Ukraine to both of them. Probably, in time enforcing the Carpathian Convention, a tourism network could find a suitable background to obtain financial support.

WG4: Ecosystem services and human wellbeing

Ecosystem services are the benefits humans receive, directly or indirectly, from ecosystems. The well-being of present and future generations depends on the continuous flow of ecosystem services. Links between human well-being and ecosystem services are complex and need consideration of different spatial and temporal scales to assess them properly.

The seven post-socialist countries of the Carpathian region, which are in transition from planned to market economy, need to adapt their "societal system of values" to new political and socio-economic conditions. This includes the value attributed to ecosystem services, which is very important to identify for different nations. Thus, the study of the relationship between ecosystem services and human well-being has received increasing attention in the Carpathian ecoregion.

Assessments of ecosystem services require estimates of changes in ecosystem processes and structures and in the resulting levels of services. At present there are no examples of ecosystem research conducted by research communities in the Carpathian. However, in the Carpathian context, there is research that could be used as a departure point for further investigations of ecosystem services, which includes:

1. Disciplinary research on: water, hazard and erosion regulations; water quality; biodiversity conservation and creation of functional network of protected areas; local scale inventories of natural resources.
2. Interdisciplinary research: role of traditional village systems for sustainable forest landscapes; resilience of natural ecosystems to natural hazards; gaps in sustainable forest management implementation on an actual landscape; trends and drivers of land use changes; etc.

However, an ecosystem assessment targeting specifically at the Carpathian ecoregion has not yet been done specifically targeted at the Carpathian ecoregion.

In the Millennium Ecosystem Assessment, the largest study ever conducted of the linkages between ecosystems and human well-being, the importance of incorporating an understanding of ecosystem dynamics into governance systems to build capacity for managing ecosystem services is highlighted (Millennium Ecosystem Assessment 2003). Therefore, the researches on governance of natural resources are also an important basis for the evaluation of ecosystem services. In the Carpathian ecoregion, research and development projects on local stakeholder involvement into the management of natural resources and forest landscape governance on local and regional levels have been conducted in different countries (for example, Carpathian Project Interreg 3B, FORZA project, WWF Project "Protection and Sustainable Use of Natural Resource in the Ukraine Carpathians" etc).

As a conclusion, there is an urgent need to develop an *ecosystem services approach* in the Carpathian ecoregion due to many radical changes in political, social and ecological environments in all countries in the ecoregion at present time. Therefore, both scientific communities and governmental organizations should conduct and support multi-scale assessments of ecosystem services.

WG5: Carpathian Waters

The state of research in the Carpathians varies between countries. The research results are dispersed and non-homogeneous. The discussion in the Water Group showed some recent and potential research topics undertaken and being developed in water science in the Carpathians. These are:

- land use change impact on water quality;
- identification of water resources (dimension, spatial distribution, temporal variability) in accordance with to the catchment boundaries;
- hydrological and biological inventory of wetlands;
- identification of ecological services provided by the Carpathian rivers and related wetlands;
- snowpack studies (snowpack recognized as an important factor influencing water resources and man activity in mountain regions);
- extreme hydrological events focused on the future;
- hydrochemical balance of catchments;
- identification of types of farming suitable for correct water management;
- development of scenarios of water balance elements changes according to climate change in all parts of the Carpathians.

Studies on long-term tendencies of basic hydro-meteorological parameters should not be given up and should be continued using better and more advanced methods. The same with monitoring of lakes, streams and biota. Palaeo-limnological research (e.g. bottom sediment analyses) are important and necessary to identify natural and anthropogenic processes which might help to assess future climatic changes and their consequences. Some Carpathian lakes have not been investigated at all (e.g. Ukrainian ones). It must be considered that climate is one of several factors influencing water resources.

The listed proposals require the creation of a common data base of hydro-meteorological parameters in the basins of rivers draining the Carpathian mega-region; such a data-base should be easily accessible for scientists involved in the Carpathian project.

All these activities should be harmonized according to "a cascade relationships" as "climate – hydrology – water management" and they need common efforts of the particular Carpathian countries (various organizations and institutions should be involved: weather and climate national services, universities, academies of sciences, and water management services). Research should be subordinated to proposals of basic strategies to secure water supplies and improve ecological health of water resources affected by climate change. It is worth to mention, that the application of some research results for climate change related processes the need for mitigation has been well recognized in some regions and particular strategies were developed e.g. in Slovakia.

Final results

The event *Science for the Carpathians (S4C) – Strategy Development and Networking Workshop* set the first milestone for the new science network for Global Change research in the Carpathian mountains. The workshop setting and environment succeeded in stimulating the discussion on how future global change research in the Carpathian region could look like and drafted the roadmap for the further development of the new science initiative.

A participatory exercise led by Marc Zebisch revealed the large number of national and international networks relevant for the Carpathians and showed that research in the Carpathians has already addressed some of the most pressing challenges in the field of Global Change (Fig. 4).

On the other hand the potential synergetic effects of such networks and research activities within the Carpathians research community are still constrained by:

- a lack of interdisciplinary, applied and pan-Carpathian research;
- lacking access of Carpathian researchers to EU-funded projects partly due to the structure of these funding schemes, but partly also due to sub-optimal scientific networking among Carpathian researchers and between Carpathians and other European countries;
- and the lack of a Carpathian research strategy.

The participants strongly support the establishment of the S4C initiative and expressed their willingness to contribute to S4C activities. At the conclusion of the workshop a roadmap was established. The main points refer to the opportunity to actively shape and steer the new S4C

initiative by:

- contributing news to the Carpathian Flash Newsflash digital-Newsletter see http://mri.scnatweb.ch/networks/;
- organizing S4C events, in particular *"Forum Carpaticum"*, a meeting of scientists and stakeholders, tentatively scheduled for September 2010 in Kraków;
- acting as a member of the steering committee;
- assisting in expanding the science network;
- proposing new projects;
- advocating the idea of S4C in their countries.

The workshop goals turned out to be highly ambitous yet, the excellent workshop spirit helped to generate ample material presented in this report. The workshop outcomes have been communicated to the representatives of the Ministerial Conference of Parties (COP) of the Carpathian Convention at the 2nd meeting in Bucharest, Romania (17-19 June 2008). A synthesis paper has been submitted to the Journal *Mountain Research and Development*.

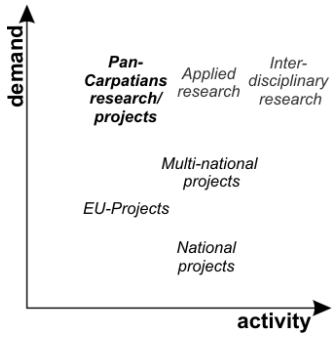


Figure 4. Analysis of existing research activities and demands in the Carpathian region

Presentations

Global Change Research in Mountain Regions

Astrid Björnsen Gurung
Global context and GLOCHAMORE Research Strategy 16

Global Change Research in the Carpathians

Jacek Kozak
Carpathian research of the Institute of Geography and Spatial Management, Jagiellonian University, in the global context 17

Luboš Halada
Outline of the biodiversity, ecosystem and land cover research in the Carpathians 19

Sebastian van der Linden, Tobias Kuemmerle, Jan Knorn, Magdalena Main, Daniel Müller, Patrick Hostert
Post-Socialist land use change in the Carpathian ecoregion 21

Elena Matei
The importance of a tourism network in the Carpathians taking the example of tourism trends in the Romanian Carpathians 22

How to organize science in the Carpathian mountains? Examples and experiences

Anna Guttova
Carpathian Ecoregion Initiative (CERI) 24

Piotr Mikołajczyk
Carpathians Environment Outlook (KEO) 26

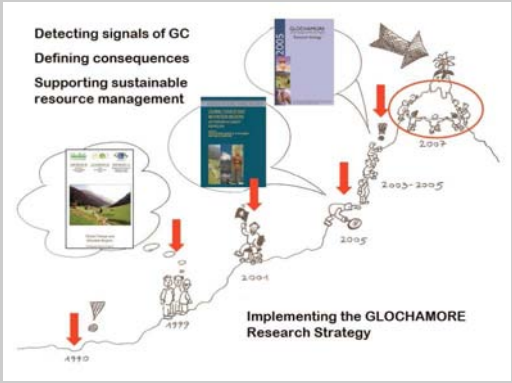




Global context and GLOCHAMORE Research Strategy

Astrid Björnsen Gurung
Mountain Research Initiative, Switzerland
bjoern@giub.unibe.ch

Keywords: Europe, Global change, mountain regions, research strategy, science networks



The Mountain Research Initiative (MRI) was established in response to the insight that *"mountain systems are at risk and need special attention, in particular with respect to possible impacts of global change. Intensified, collaborative and coordinated research is required, which can be fostered through an international research program"* (IGBP Report 43, p. 31). Since 2001, the MRI promotes and coordinates research on global change in mountain regions around the world as an official body. It also actively participates in the design of the international research agenda.

One important milestone in the history of MRI was the GLOCHAMORE (Global Change and Mountain Regions) Research Strategy (Björnsen Gurung 2005). This strategy was the product of a Specific Support Action managed jointly with the University of Vienna under the EU's 6th Framework Programme on "Sustainable Development, Global Change and Ecosystems". The goal of the project was a state-of-the-art integrated and implementable research strategy to gain a better understanding of the causes and consequences of global change in mountain regions. The strategy was developed with the participation of managers from 28 UNESCO Mountain Biosphere Reserves around the world.

The strategy emphasizes that disciplinary research must occur within an Earth system context. The 10 headings and 41 themes are clearly disciplinary. But the organization of themes under headings reflected an Earth system approach, starting with drivers, principally climate and land use change, proceeding to biophysical systems, such the cryosphere and ecosystems, then to ecosystem services, such as biodiversity and natural resources, and concluding with socio-economic concerns. This approach is congruent with "whole system" approach of the Earth System Science Partnership (ESSP: Amsterdam Declaration 2001) and the Science Plan of the joint IGBP/IHDP Global Land Project (GLP 2005), but emphasizes the coupled human-Earth system at the scale of mountain regions rather than at the scale of the entire planet.

The work program of the GLOCHAMORE project expected implementation of the strategy in European Biosphere Reserves. As this attempt did not yield success, a different approach was taken, this time focusing on scientists regardless of their affiliation with place and funding. For that purpose, a meeting on global change in European mountains was organized in February 2007 in Zurich, with a sub-title emphasizing funding through the European Commission's 7th Framework Programme for Research and Development. The meeting provided a platform for networking and the development of project ideas and proposals. This event attracted almost 100 scientists who contributed with their spirit to the launch of "MRI Europe", one of the most active regional science networks of the MRI.

Since then, "MRI Europe" is the information clearinghouse for the network members. Considerable time is allocated for implementing the GLOCHAMORE Research Strategy through the development of research proposals, be it as an initiator or a partner. MRI Europe organizes and facilitates events furthering the strategic development and implementation of mountain research, maintains a web page and database, and compiles bi-monthly electronic newsletters for the regional networks.

As scientists from the Carpathian countries have not been adequately represented in the European science network although their aims are congruent with those of the MRI, the MRI Europe program has committed itself to facilitate and support the establishment of the Science for the Carpathians (S4C) initiative to further mountain research in the region.

References

Amsterdam Declaration, 2001, Available at http://www.essp.org/index.php?id=41&L=en.

Becker A, Bugmann H (eds), 2001, *Global change and mountain regions: The Mountain Research Initiative.* IHDP report 13, GTOS Report 28 and IGBP Report 49, Stockholm.

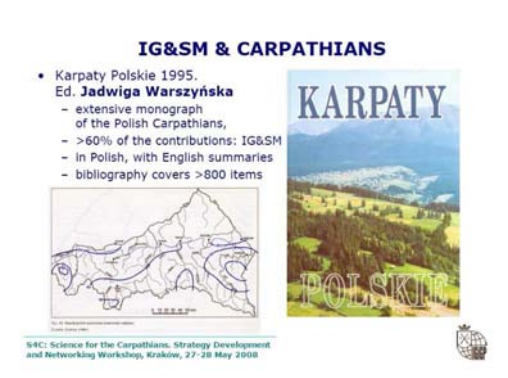
Björnsen Gurung A (ed), 2005, *The Global Change in Mountain Regions Research Strategy*. UNESCO and MRI, ADAG Press, Zürich, 47 pp.

GLP 2005 *Science Plan and Implementation Strategy*. IGBP Report 53/IHDP Report 19, IGBP Secretariat, Stockholm, 64 pp.

Carpathian research of the Institute of Geography and Spatial Management, Jagiellonian University, in the global context

Jacek Kozak
Institute of Geography and Spatial Management, Jagiellonian University, Poland
jkozak@gis.geo.uj.edu.pl

Keywords: Carpathian research, Global Change, Mountain reaserach



Kraków became an important academic centre already in the 14th century. Since then, a rich record of research in the field of natural sciences has been gathered. The institutional geography in Kraków started in 1849 when Wincenty Pol founded the Chair of Geography at the Jagiellonian University, defining the Carpathians as one of key study areas. Throughout the 19th and 20th century a huge number of studies were carried out by the staff of the Institute, mostly in the northern Carpathians, encompassing a wide extent of topics. In the beginning, research was focused mostly on geomorphology, climatology, and population geography, later on also hydrology, land use studies, geoecology, soil geography and human geography became important (Kortus et al. 1999). With time, a variety of topics has grown, resulting in a major synthesis in the early 1990s (Warszyńska 1995). Currently, most of the strategy areas listed in the GLOCHAMORE strategy (GLOCHAMORE 2005) are well represented except those which have little or no relevance to the Carpathian area, e.g., due to the limited extent of high alpine environments

Table 1. GLOCHAMORE strategy areas in the Carpathian studies of IG&SM. Grey – areas represented in the current research activities of IG&SM

1. Climate	**2. Land Use Change**	**3. Cryosphere**	**4. Water Systems**	**5. Ecosystem Function and Services**
Various areas	Quantifying and monitoring of LU	Glacier extent	Water quantity	Role of Alpine Areas in N and Water Cycles
6. Biodiversity	Understanding the origins and impacts of LUC	Glacier Mass Balance, Melt Water Yield	Water quality and Sediment production	Role of Forest in C Cycle and Resource Production
B. assessment and monitoring	**10. Society and Global Change**	Snow cover	Aquatic Community Structure	Role of Grazing Lands in C, N and Water cycles, Slope Stability and Household Economy
B. functioning	Governance Institutions	Snow melt	**9. Mountain Economies**	Soil Systems
B. management	Rights and Access to Water Resources	Permafrost	Employment and Income	Pollution
Alpine Community Change	Conflict and Peace	**7. Hazards**	Forest Products	Plant Pests and Diseases
Key Flora and Fauna	Traditional Knowledge and Belief Systems	Floods	Mountain Pastures	**8. Health Determinants and Outcomes Afflicting Humans and Livestock**
Forest Structure	Development Trajectory and Vulnerability	Wildland Fire	Valuation of Ecosystem Services	Various areas
Culturally Dependent Species	Urbanization in Mountain Regions	Mass Movements	Tourism and Recreation Economies	
Impacts of Invasive Species		Avalanches		

and lack of glaciers, or a very low threat of certain environmental or political hazards (Tab. 1). Studies of biotic environmental components (vegetation, fauna) and biodiversity are also infrequent since they are the core research domain of other institutes of the Jagiellonian University (e.g., Botany, Environmental Sciences, Zoology).

References

GLOCHAMORE, 2005, *Global Change and Mountain Regions Research Strategy*.
On-line at: http://mri.scnatweb.ch/index.php?option=com_docman&task=cat_view&gid=57&Itemid=61accessed September 2008.

Kortus B, Jackowski A, Krzemień K (eds), 1999, *Dzieje Katedry i Instytutu Geografii Uniwersytetu Jagiellońskiego 1849-1999*. Instytut Geografii Uniwersytetu Jagiellońskiego, Kraków.

Warszyńska J (ed), 1995, *Karpaty Polskie*. Uniwersytet Jagielloński, Kraków.

Acknowledgements

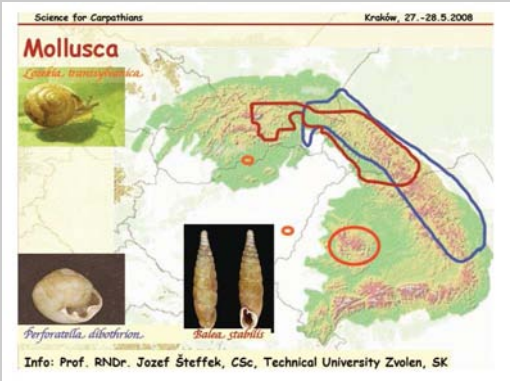
Elżbieta Bilska-Wodecka
Anita Bokwa
Małgorzata Ciemborowicz,
Marek Drewnik
Krystyna German
Czesław Guzik
Robert Guzik
Miłosz Jodłowski
Mirosław Mika
Małgorzata Pietrzak
Joanna Pociask-Karteczka
Jolanta Święchowicz
Bartosz Załuski
Mirosław Żelazny

Pieniny Mts.

An outline of the biodiversity, ecosystem and land cover research in the Carpathians

Ľuboš Halada
Institute of Landscape Ecology SAS, Slovakia
lubos.halada@savba.sk

Keywords: Carpathians, biodiversity research, land use, land cover, ILTER



The ecosystem research in the Carpathians is performed especially in the framework of global initiatives like International Long-Term Ecological Research (ILTER) or European ones like ICP Forest. ILTER has quite long tradition in the Carpathian countries; it was co-ordinated by the ILTER regional network for Central and Eastern Europe since 1995. During 11 years, 9 regional workshops were held and 5 international projects were implemented in this region. Since 2007, LTER research in this region is organised in the framework of LTER Europe. The number of 14 LTER sites are located in Carpathians; they are focused mainly on ecosystem research of forests and alpine grasslands. The ICP Forest network is quite extensive in the Carpathians, with several topics studied. Plots of level II are focused on ecosystem properties, impact of air pollution on the health of the forest; in the last years they have been included to projects like Forest Focus or demonstration projects ForestBIOTA and BioSoil.

Biodiversity research in the Carpathian countries is organised through several types of organisations: academies of sciences, universities, research organisations administrated by government departments and NGOs. Several important mapping and monitoring activities were or are realised in the Carpathians: Important Bird Areas, Important Plant Areas, National grassland inventories, Prime Butterfly Areas, mapping and monitoring related to Natura 2000 requirements. All of them are focused to a broader territory, not only to the Carpathians. Projects specifically devoted to the Carpathians are rare, one example is given by the project "Effects of Air Pollution on Forest Health and Biodiversity in Forests in the Carpathian Mountains". This project was performed in 26 sites in the Carpathians – in the Czech Republic, Poland, Slovakia, Hungary, Ukraine and Romania. The sampling was done in 1998 and 2005; results from the first period were published by Grodzinska et al. (2004). The Carpathians are represented in the worldwide network GLORIA (the network for evaluation and monitoring of the climatic change impact on biodiversity in a high-mountain environment) with 2 sites, located in the High Tatra Mts. (Slovakia, Western Carpathians) and the Rodna Mts. (Romania, Eastern Carpathians).

Biodiversity research in the Carpathians is rich, but usually country-based. This is one of the reasons why it is difficult to summarize it, therefore only examples are reported in this paper. Here we demonstrate different focus of biodiversity-related research in 3 examples of projects from Hungary: "The origin and genesis of the fauna of the Carpathian Basin: diversity, biogeographical hotspots and nature conservation significance" co-ordinated by the Hungarian Natural History Museum; "Ethno-ecological research in the Eastern-Carpathians" and "Biodiversity research in forest reserves" both coordinated by Institute of Ecology and Botany HAS (Vácratót). Besides the research performed in Ukraine by native organisations and scientists, the Mendel University (Czech Republic) works in re-establishment and re-census of the forest typological plots originally established by A. Zlatník in 1920-s and 1930-s.

Land cover and land use research has a rich tradition in the Carpathians, especially in Slovakia, Poland and Czech Republic. However, currently the only unified land cover product for the Carpathian countries (except Ukraine) was produced in the European project CORINE Land Cover (CLC) for years 1990 and 2000 (for 2006 in progress). Its temporal coverage for 4 countries (CZ, HU, SK and RO) was extended to the 1970s and published by Feranec et al. (2000), 7 types of landscape changes were studied. In Slovakia, the land use changes are studied in numerous case studies using data from military mappings since the second half of the 18-th century (starting 1782) and air photos (usually years 1949, 1987, 2003). The results of these case-studies were published in several monographs in the Slovak language. Landscape changes in the Carpathians were studied in the framework of several international projects as well. The 5-th Framework project BIOPRESS (Linking Pan-European Landcover Change to Pressures on Biodiversity) studied landscape changes 1950-1990-2000 and interpreted them as pressures to biodiversity: agriculture intensification, abandonment, fragmentation, drainage, afforestation, and urbanisation. In total, 15 windows of the

size 30x30 km and 8 transects 15x2 km were located in the Carpathians. The target scale was 1:100.000 for windows (using CLC level 3 legend and related spatial parameters) and 1:10.000 for transects (Gerard et al., 2006). The landscape changes 1949-2003 on the regional level were studied in the project BioScene (Scenarios for reconciling biodiversity conservation with declining agricultural use in the mountains of Europe). The study area in the Carpathians was located in the Poloniny National Park (NE Slovakia, bordering on Poland and Ukraine). The project was quite complex, the landscape changes were studied in parallel stretches focusing on socio-economic analysis, ecological modelling (on the levels of species, habitats and landscape) and sustainability appraisal (Bezák et al., 2007). Besides the past landscape changes, the forecast of future directions of changes were predicted using the scenario approach.

References

Bezák P, Halada Ľ, Petrovič F, Boltižiar M, Oszlányi J, 2007, *Bukovské vrchy in Slovak Carpathian Mts. – landscape changes and trends.* In: U. Mander, K. Helming, H. Wiggering (eds) *Multifunctional Land Use - Meeting Future Demands for Landscape Goods and Services*. Springer Verlag, Berlin, Heidelberg, 355-367.

Feranec J, Suri M, Ot'ahel' J, Cebecauer T.V, Kolar J, Soukup T.V, Zdenkova D, Waszmuth J.V, Vajdea V, Vijdea A-M, Nitica C, 2000, *Inventory of major landscape changes in the Czech Republic, Hungary, Romania and Slovak Republic 1970s - 1990s*. International Journal of Applied Earth Observation and Geoinformation 2: 129-139.

Gerard F, Thomson A, Wadsworth R, Gregor M, Luque S, Huitu H, Köhler R, Olschofsky K. Hazeu G, Mucher S, Halada Ľ, Bugár G, Pino J, 2006, *Land cover change in Europe from the 1950ies to 2000*. *Aerial photo interpretation and derived statistics from 59 samples distributed across Europe.* Institute for Worldforestry, University of Hamburg, 364 pp.

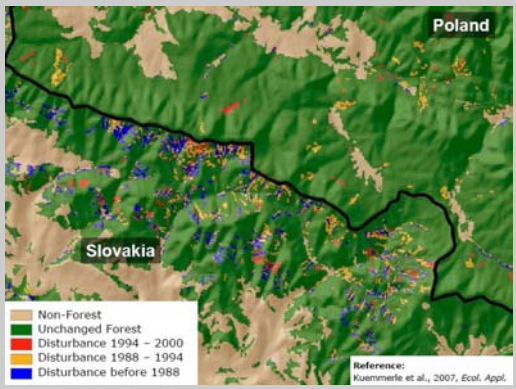
Grodzinska K, Godzik B, Fraczek W, Badea O, Oszlányi J, Postelnicu D, Shparyk Y, 2004, *Vegetation of the selected forest stands and land use in the Carpathian Mountains*. Environmental Pollution 130: 17-32.

Mala Fatra

Post-socialist land use change in the Carpathian ecoregion

Sebastian van der Linden, Tobias Kuemmerle, Jan Knorn, Magdalena Main, Daniel Müller, Patrick Hostert
Geomatics Lab, Humboldt Universität zü Berlin, Germany
sebastian.linden@geo.hu-berlin.de

Keywords: Carpathian mountains, land use change, remote sensing, land abandonment



The Carpathians are Europe's largest temperate forest ecosystem, a biodiversity hotspot, and rich in traditional cultural landscapes. Changing politics and socio-economics after the fall of the Iron Curtain have resulted in widespread land use change, including farmland abandonment and logging. This poses threats and opportunities for Carpathian ecosystems and biodiversity; yet, little is known about the rates and spatial patterns of post-socialist land use/cover change. We mapped land cover change from Landsat TM and ETM+ images from 1988 to 2007 in four different study regions in Poland, Slovakia, Romania, and Ukraine.

Results showed that processes affect different regions at varying extent. The intensity of the processes also varied with time. For example, farmland abandonment was widespread in all countries but abandonment rates were highest in Slovakia. Logging was particularly intensive in the early transition years and occurred at highest rates in Ukraine. The influence of environmental factors such as forest disturbance caused by air pollution also showed specific spatio-temporal patterns.

New methodologies were successfully tested in order to extent remote sensing based hotspot analyses to more operational mapping at large scale. This included the use of support vector machines in combination with a chain classification approach that incorporates information from overlapping satellite images for supervised image classification. As a first test area, land cover and forest cover change were mapped for all of Ukraine. Given the high accuracy of results, this approach shall be extended for all of the Carpathian ecoregion.

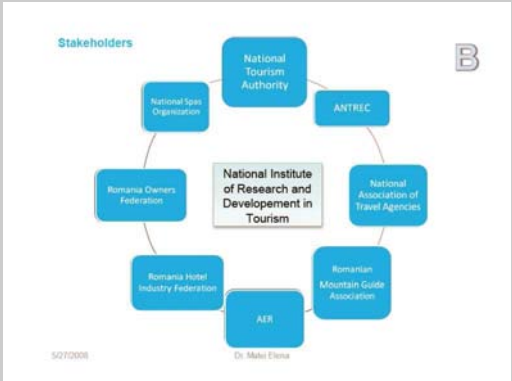
Our results underline that remote sensing has tremendous potential to map land change in transition areas and can make a strong contribution towards safeguarding Carpathian ecosystems.

The Chornohora

The importance of a tourism network in the Carpathians taking the example of tourism trends in the Romanian Carpathians

Elena Matei
University of Bucharest, Romania
matei@geo.unibuc.ro

Keywords: Tourism network, Carpathians, scientists, stakeholders



The Carpathians have a great potential for tourism, industry, breeding and forestry. As they faced dystrophic issues due to the economics and politics of the last 50 years, tourism is seen as a panacea for economic revival.

In tourism, many businesses found a niche for prosperity. Thus, Romanian Carpathians display a diversification of tourism types, a bloom of tourists' facilities, but also underdeveloped infrastructure and uncontrolled tourism practices. The diversity of tourism types includes together with classical forms an increase of religious tourism, a bashful ecotourism, which could benefit from the large and numerous protected areas, winter-sports with or without specific facilities, and widespread of agritourism and rural tourism.

The "laisser faire" development of infrastructure brings, beside an increase of tourist accommodation units, villas, guest houses, secondary residential houses. The economic transition period lasted many years and the ownership changes of big hotels from state to private took place only slowly. Their closure cause a decrease of the total capacity.

Although the demand for the Carpathians as tourist destination shows a reduction of internal arrivals, rise in international arrivals can be observed. In the last five years, vacation length declined while week-end travels prevail, (Tab. 1). The tourists' profile is composed mainly of employees, adults less than 44 years old and youths. The check-in rate has fallen to less than 50%, because of accommodation in secondary owned residences or to friends and relatives places is cheaper, (Tab. 2). Few packages are demanded on the internal market, thus many tourism companies are oriented to the foreign offers. To mitigate negative impacts of tourism or other businesses dependent on forests, quarries, mining etc., all facing the global climate changes, the Carpathians require coherent politics of development.

Carpathian tourism needs smart strategies fastening sustainable development in those tourist destinations. The strategies should build on the common use of the socio-economy and infrastructure of local communities and business investors. At the same time, if tourism gives relaxation, recreation and knowledge, it should run or provide equilibrium, aesthetics and harmony with the environment. To achieve this, represen-

Table 1. Romanian Carpathians Tourism-Facts and Figures (1994, 2005)

Variables	1994		2005	
	Carpathians	Romania	Carpathians	Romania
Tourist accommodations	608	2 840	828	4 226
Capacity (beds)	37 321	292 479	33 196	282 661
Tourists	924 000	7 005 000	828 000	5 805 000
Foreigners	65 000	856 000	113 000	1 430 000
Staying over nights	3 227 000	23 296 000	2 013 000	18 373 000
Foreigners	284 000	2 756 000	264 000	3 464 000
Length stay %	40,3	43,7	22	33,4
Index of use net capacity (days)	3,5	3,3	2,4	3,2

source: National Institute of Statistics, 2007

tatives from industry, development agencies and stakeholders should consult with scientists.

The tourism network is seen as a partnership between institutions and scientists competent in tourism studies or development and interested in sustainable development of tourism in a changing world. It can be a clearinghouse for tourism based knowledge, composed by experts from universities and research institutes interested to transfer knowledge from academia to industry.

The tourism network could composed by experts, stakeholders or both, the latter ensuring inter- and transdisciplinary studies or puting theory into practice. This mixed variant could be projected to cober all aspects of tourism creating functional relationships among scientists.

In Romania, the National Tourism Autority leads several organizational rings at the national level. It interacts with The National Spa Organization, National Agency for Rural Cultural and Ecological Tourism, Romania Owners Federation, National Association Travel Agencies, Romania Mountain Guides Association, Romania Hotel Industry Federation, and Romania Ecotourism Association. To avoid this brake up, the tourism network for Carpathians could bridge the gap between science and practice. Scientists, people from administration, and stakeholders could join integrative and trans-disciplinary research for development, trying to take into account all conjunctive or disjunctive environmental, economic issues.

As scientific tourism network, it would deal with research, projects, and meetings, and supply products for developers, local stakeholders and administration. However, as such it would receive insufficient feedback from the end-users. In Romania, a scientific network has been established, linking five state faculties and two private ones, with the option to join similar networks in other Carpathians and Balkans countries.

The tourism network for Carpathian is seen as a segment of S4C congruent with the GLOCHAMORE research strategy and r*esearch goal: to characterize the tourism and recreation sectors and to project their future-support for sustainability* focusing on*:*-Analyze the current nature of tourism and recreation in terms of activities offered, sources of clients and economic impact;

- Assess the impacts of global change on the different types of tourism and recreation and as source of global changes;
- Project the future nature and extent of tourism and recreation as a function of global change scenarios;
- Give and receive experts' help in development of sustainable tourism products, sustainable tourism resources management;
- Support to continuous improving of expertise;
- Use, integration and spreading of good practices in tourism.

Table 2. Tourism Trends in Romanian Carpathians (1994, 2005)

Variables	Trends (1994; 2005)	
	Carpathians	Romania
Tourist accommodations	26,5%	32,7%
Capacity(beds)	-11%	-3,4%
Tourists	-10%	-17%
Foreigners	89%	67%
Staying over nights	-37,6%	-21%
Foreigners	-7%	20%
Length stay %	-40%	-23%
Index of use net capacity (days)	-31%	-3%

source: National Institute of Statistics, 2007

Carpathian Ecoregion Initiative (CERI)

Anna Guttova
CERI Bratislava, Slovakia
guttova@daphne.sk

Keywords: Biodiversity, Nature Conservation, Ecosystem assessment, Carpathian ecological network, Carpathian convention

In 1999 the Carpathian Ecoregion Initiative was born as an informal consortium of more than 50 organisations (governmental, non-governmental, funding, scientific and academic) from seven countries of the Carpathian region with the shared aim to conserve the globally-important biodiversity of the Carpathians, and at the same time, ensure sustainable livelihoods. The CERI was first known as 'Ecoregion Based Conservation in the Carpathians', and it evolved out of the platform of the WWF's Global 200 Program, designed to provide the blueprint to stem the loss of biodiversity occurring on an ecoregion scale.

The main output of the early stages of the Initiative was the drafting of the 'Status of the Carpathians' (2001), published in both English and local Carpathian languages. The status was derived from a two year adaptive reconnaissance and assessment process - conducted by joint international working groups and experts on: biodiversity, forests, plant communities, vascular plants, large carnivores and herbivores, birds, amphibians and reptiles, insects, rivers and fish, water and flood management, protected areas, tourism and recreation, sustainable development, socio-economics, industry, energy, mining, transport and agriculture. The document presented for the first time the threats and values of the region. The most important specific result to emerge from the Status Report was the identification of 30 Priority Areas for Biodiversity Conservation in the Carpathians, based on results of biodiversity assessment indicating areas of "very high" and "high" biodiversity values, which will be used in the next phase of the CERI in the 'Carpathian Ecoregional System of Protected Areas' project to strengthen and extend the management of the network of protected areas of the Carpathians.

Since 2005 CERI network operates through a secretariat based in Bratislava, Slovakia. The overall objective of the CERI is using regional planning framework to distill focused conservation schemes across key landscapes towards the design, creation and long-term management of a Carpathian Ecological Network. CERI aims to achieve that objective by performing three main roles for its members:

- a Convention Network: The CERI will have contributed and influenced the achievement of a strong, focused Carpathian Convention. The Secretariat and parties to the Convention recognize CERI as an effective grass-roots, civil society partner for implementation and development of the Convention.
- a Network for Sustainable Development: The CERI network will support sustainable development in the Carpathians linking it always to the creation of a Living Carpathians.
- a Scientific Network: CERI is the recognized first-stop regional source of data and information and the centre of expertise for biodiversity and biodiversity conservation in the Carpathians.
- a Network Support: The CERI membership is an effective and efficient organization with the capacity to deliver on its objectives through its approach providing support and equal opportunities to all its members.

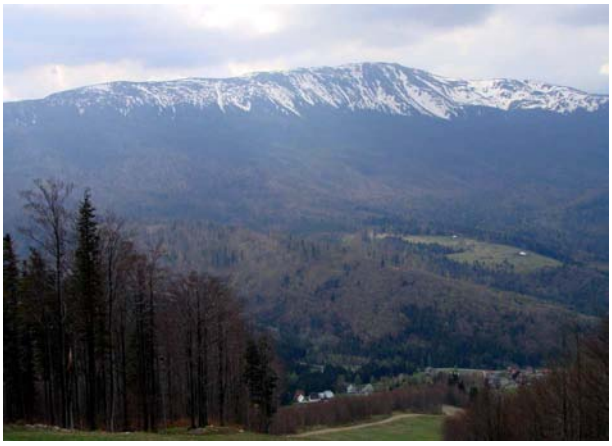
CERI partners with international bodies (e.g. Interim Secretariat of Carpathian Convention, Carpathian Network of Protected Areas, Carpathian Wetland Initiative), initiates cooperation, joins other regional initiatives and contributes to the activities of other international networks (WWF-DCP, CEEWEB, REC, ANPED, ECNC) in order to strengthen the influence at the international political level and prevent overlaps in activities.

CERI´s current activities are focused to expert activities and policy and networking. With its partners CERI is implementing two projects aiming at the development of a Carpathian Ecological Network. Their immediate objective is to design a coherent transboundary ecological network, being an interactive map with zonation and implementation recommendations, a comprehensive management tool for the governments. Outcomes include also increased understanding of the NGOs on the principles and techniques of ecological network development and implementation (Natura 2000, Emerald, PEEN),

a joint Carpathian Biodiversity Information System and strengthened capacities of CERI to support implementation of the Carpathian Convention. CERI participates at the project focused on building awareness and promoting Carpathian mountain curricula throughout the region – "World of Carpathians – Awareness raising about the Carpathian Biodiversity". Its objective is to prepare a methodical teaching handbook about the Carpathian biodiversity for teachers and other educators and information material for public. Both materials will be so far published in three language versions: in English, Slovak and Polish.

More information available on www.carpates.org.

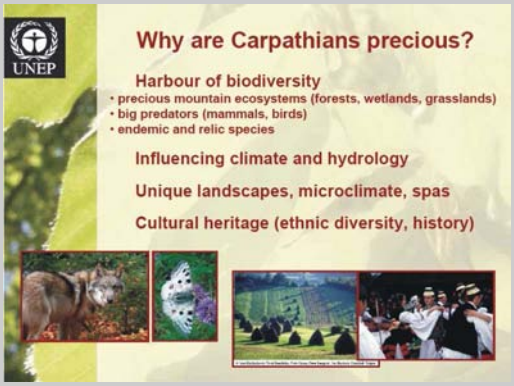
The Babia Mt.



Carpathians Environment Outlook 2007 (KEO)

Piotr Mikołajczyk
UNEP/GRID Warsaw, Poland
piotr@gridw.pl

Keywords: Environment, report, UNEP, Carpathians



The *Carpathians Environment Outlook* (KEO) report is a sub-regional examination and synthesis of the environmental situation in the greater Carpathian region that includes parts of seven countries (the Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia and Ukraine). It was created in a "bottom-up", collaborative and consultative style and under co-ordination of the UNEP's Division of Early Warning and Assessment (DEWA) and Regional Office for Europe (ROE) in Switzerland. A wide range of participants from the Carpathian region were involved in the KEO project, including seven National Focal Points (NFPs), regional NGOs, academic institutions, independent experts, Chapter Lead Authors, a Lead Data Centre based at the UNEP/GRID-Warsaw Centre. The original idea to produce this Report came in an official request of the Czech Minister of Environment in March 2003. Further on, the KEO 'Kick-Off' Meeting, held for exploratory purposes at the Ministry of Environment and Water in Budapest, Hungary, in 2004, emphasized the interest of Parties to the Carpathian Framework Convention (CFC) in preparing such a report. The uniqueness of the KEO relies on its integrative nature. KEO is not meant to be a composite of seven national reports, but a geographically integrated report on the state and trends in the Carpathians environment, retrospectively over the past 30 years and forward to 2020.

Much like its parent products, UNEP's series of Global Environment Outlook (GEO) assessment reports at the global level, KEO uses the Driving Forces-Pressure-State-Impact-Response (DPSIR) methodology developed by the European Environment Agency (EEA) and applied to organize and classify environmental and socio-economic information in terms of the causal chain of human-environment interactions. The KEO report focuses on sustainable development issues, notably the economic efficiency and environmental effectiveness of policy actions. It provides a comprehensive evaluation and analysis of socio-economic and environmental phenomena and processes taking place in the Carpathians, such as biodiversity, forestry, sustainable use of natural resources, environmental security, agriculture, traditional lifestyles, tourism, energy, transport, etc. Three different development scenarios are presented, as well as a number of specific case studies of environmental, social, and economic Carpathian "hotspots".

Main clients of the report are decision-makers at national, regional and local level, scientific community, civil society and international community including international financial institutions and the business sector.

The KEO report was launched in October 2007 and is available on-line at:

http://www.grid.unep.ch/activities/assessment/geo/KEO and/or: http://www.gridw.pl/keo

The Chornohora

Posters

Astrid Björnsen Gurung
The Mountain Research Initiative 28

Anita Bokwa, Zbigniew Ustrnul
Climate change in the Polish Carpathians and its environmental and social impacts 29

Barbara Godzik
Tropospheric ozone concentrations in the Carpathians and its effect on plants 31

Wojciech Grodzki
Spatial characteristics of bark beetle infestations in selected areas in the Carpathians 32

Anna Guttova
Development of the Carpathian Ecological Network 33

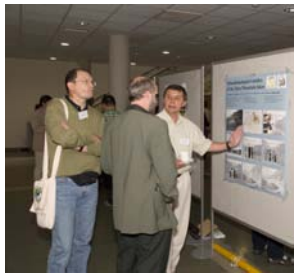
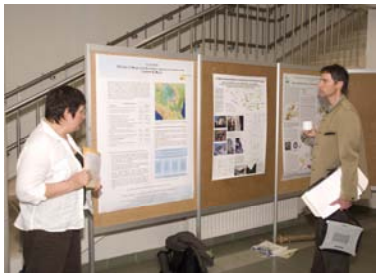
Ivan Kruhlov
Recent geoecological studies in the Ukrainian Carpathians 34

Katalin Mázsa , Eszter Tanács
Broadleaved forest reserves facing climate change: scenarios at the lower precipitation forest zone 35

Katarzyna Ostapowicz , Mateusz Troll, Joanna Depta, Dominik Kaim, Natalia Kolecka, Jacek Kozak, Izabela Sitko, Aneta Szablowska-Midor
Land Cover, Land Use and Landscape Changes in the Carpathians 36

Andrea Samu
Changes in the state of the karstic lakes of the Slovak and Aggtelek karst 38



The Mountain Research Initiative

Astrid Björnsen Gurung
Mountain Research Initiative, Switzerland
bjoern@giub.unibe.ch

The Mountain Research Initiative (MRI) promotes and coordinates research on global change in mountain regions around the world. It is funded by the Swiss National Science Foundation and has offices at the University Berne and the University of Lausanne, Switzerland.

The MRI is concerned with the development of mountain environments under economic and climatic global change concentrating on the research section of this community. The MRI goal, as enunciated in IGBP Report 49, is to foster research that detects the signals of global changes, assesses the impacts of these changes for natural ecosystems as well as for human societies, and contributes to the sustainable management of mountain resources. As MRI is a promotion and coordination effort, it seeks to achieve these goals through three strategic activities: framing research approaches, influencing funding, and developing cohesion of the research community through communication.

The GLOCHAMORE (Global Change in Mountain Regions) project laid the strategic foundation of MRI's present activities. It was funded by the 6th Framework Programme of the EU from 2003 to 2005, and framed a global change research agenda for mountain regions worldwide. The output was a integrated and implementable research strategy to understand the causes and consequences of global change in mountains. Critical to the development of the strategy was the participation of 28 UNESCO Mountain Biosphere Reserves (MBRs) and the integration of activities and knowledge from both natural and social sciences. The publication of the GLOCHAMORE Research Strategy in 2005 capped a two-year effort consisting of four thematic workshops and a final Open Science Conference. The strategy lays out the rationale, research goals and actions for twelve disciplinary themes, but also advocates an integrated approach both across disciplines (interdisciplinarity) and between science and stakeholders (transdisciplinarity) (see also page 15).

In 2006 the MRI broadened its focus from strategy development on a global level to the initiation and support of regional networks of global change researchers. With the GLOCHAMORE Research Strategy the MRI had produced a framework for research, but it is principally through the regional networks that the strategy becomes tangible. MRI started several regional initiatives to tackle this translation. Following the April 2006 conference "Climate Change: Organizing the Science in the American Cordillera" held in Mendoza, Argentina, MRI facilitated the launch of the American Cordillera Transect.

The advent in December 2006 of a call in the EU Seventh Framework Programme for research on climate change impacts on vulnerable mountains regions galvanized MRI's European community and greatly accelerated the formation of a Global Change Research Network in European Mountains (MRI Europe). MRI launched the network at a workshop on February 1 and 2 in Zürich, Switzerland: "Developing a Global Change Research Network in European Mountains: Going Beyond FP7". The workshop attracted a large audience: almost hundred scientists from twenty-one countries, including the Eastern European countries, and Turkey. MRI structured the workshop in the light of the FP7 Call. Coordinators of consortia responding to the Call were invited to describe their projects. Participants interested in joining a proposal had the opportunity to describe their research.

MRI is currently working with the Monsoon Asia Integrated Research Study and with the CGIAR and a host of African institutions to develop networks in Monsoon Asia and Africa, respectively.

The regional networks initiated and supported by MRI have several purposes:

- exchange between global change scientists,
- coordination of scientific information, and
- initiation of integrative and comparative studies.

Climate change in the Polish Carpathians and its environmental and social impacts

Anita Bokwa, Zbigniew Ustrnul
Institute of Geography and Spatial Management, Jagiellonian University, Poland
anita.bokwa@uj.edu.pl

1. Climate change

Climate of the Polish Carpathians has been studied in the Department of Climatology, Institute of Geography and Spatial Management (IGSM), Jagiellonian University (JU), Cracow, Poland since 1960s in various spatial and temporal scales (e.g. Olecki 1992, Limanówka, Ustrnul 1993, Obrębska-Starklowa et al. 1994, 1995, Niedźwiedź et al. 1994). In 1965 Professor Mieczysław Hess established the general scheme of the vertical climatic zones in the Central European mountains and compared them with the ones in the Alps and in the Caucasus Mts (Hess 1965).

At present mainly air temperature and precipitation are studied in connection with the atmospheric circulation, using data from the stations located in a vertical profile, e.g.:

1. Kasprowy Wierch Mt.: 1991 m asl, the Tatra Mts.,
2. Hala Gąsienicowa: 1520 m asl, the Tatra Mts.,
3. Zakopane: 857 m asl, the Tatra Mts. foothills,
4. Gaik-Brzezowa: 302 m asl, the Carpathian Foothills,
5. Cracow (Kraków): 206 m asl, the Carpathian foreland.

In the years 1951-2006 temporal air temperature changes were similar at all stations, but the stations located in the High Tatra Mts. show e.g. smaller interannual variability. Positive long-term air temperature trends can be observed at all stations but they are the largest in Zakopane and Kraków, which are both located in the concave landforms and urban areas. In 1990s a significant air temperature increase can be observed at all stations which makes that period the warmest in the whole studied series.

Within the project COST 719 the maps of mean annual air temperature were completed using a few methods of GIS spatial analysis, mainly residual kriging. The Tatra Mts. are characterized by a very high spatial variability of air temperature distribution in comparison to the rest of the country. This region has the climatic features typical for alpine and sub-alpine zones (Ustrnul, Czekierda 2003).

In the vertical profile, the mean annual air temperature is best correlated with the westerly atmospheric circulation, represented by the NAO index in Cracow and the correlation coefficient value decreases with the altitude. The Tatra Mts. are the area where the atmospheric circulation has rather limited influence on the annual air temperature, although the spatial pattern of the correlation coefficient is complicated and dependent on the relief. The Tatra Mts. are also the area with the highest annual sums of precipitation (about 2000 mm) and the highest probability of extreme meteorological events, e.g. torrential rainfalls, producing floods, like the daily precipitation of 300 mm at Hala Gąsienicowa in 1973, the national record.

2. Water resources management

The IGSM JU has two research stations in the Carpathian Foreland: in Łazy and in Gaik-Brzezowa. The station in Gaik-Brzezowa is located by the Dobczyce Water Reservoir, a source of over 50% of potable water for Cracow. The reservoir is closed for any human activity which is the reason for a conflict between the local authorities and the voivodeship environmental protection department. In 2006, the Institute participated in a project "New environmental touristic strategy for rural sustainable tourism", realized by the Dobczyce Community and part-financed by the European Union within the Interreg IIIC Initiative. New touristic infrastructure, not endangering the reservoir water quality, was constructed, and the station became a part of it (Ekoturystyka... 2006).

3. Social impacts

In the years 2005-2008, a project entitled "Public attitudes and behaviours concerning the extreme natural phenomena in Southern Poland" has been carried out in the IGSM JU to study the public perception of floods, strong winds and landslides in a representative group of Polish citizens, living in rural and urban areas, in mountainous, foothills and lowland regions, who experienced the said extreme phenomena or

those who did not. People living in the mountains feel more endangered by the strong winds than those living in other areas, while in the case of floods and landslides it is opposite. In mountainous localities people are more sceptic about the possibilities of diminishing the flood and landslides' losses than in lowlands, but much more optimistic in the case of strong winds. In case of all phenomena, the inhabitants of mountainous localities are much more willing to undertake the protection activities against the extreme phenomena by themselves than people in the lowlands, who prefer to count on local or higher level authorities (Biernacki et al. 2007).

References

Biernacki W, Bokwa A, Domański B, Działek J, Janas K, Padło T, 2007, *Mass media as a source of information about extreme natural phenomena in Southern Poland*. Proceedings of the International Conference "Climate Change Communication", Braga, Portugal, 19-21 Nov., 2007.

Bokwa A, Malinowski M (eds), 2006, *Ecotourism as a development chance for the communities located around the dobczyce Water Reservoir* [in Polish]. Urząd Gminy i Miasta Dobczyce, Dobczyce.

Hess M, 1965, *Climatic vertical zones in the Polish Western Carpathians* [in Polish]. Zeszyty Naukowe Uniwersytetu Jagiellońskiego 11.

Limanówka D, Ustrnul Z, 1993, Changes of sunshine in the altitude profile of the Polish Western Carpathians, "Early Meteorological Records in Europe - Methods and Results", Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Geograficzne 95: 115-124.

Niedźwiedź T, Ustrnul Z, Cebulak E, Limanówka D, 1994, *Long-Term Climate Variations in Southern Poland Due to Atmospheric Circulation Variability*. In: R. Heino (ed) *Climate Variations in Europe*. Helsinki, 263-277.

Obrębska-Starklowa B, Bednarz Z, Niedźwiedź T, Olecki Z, Trepińska J, 1994, *Natural and anthropogenic fluctuations and trends of climate change in Southern Poland.* In: L. Starkel, M. Gutry-Korycka (eds) *Global change: Polish Perspectives*. Geographica Polonica 62: 7-22.

Obrębska-Starkel B, Bednarz Z, Niedźwiedź T, Trepińska J, 1995, *On the trends of the climate changes in the higher parts of the Carpathian Mountains.* In: *Environmental aspects of the timberline in Finland and in the Polish Carpathians*. Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Geograficzne 98: 123-151.

Olecki Z, 1992, *Global solar radiation on the north-facing slope of the Carpathian Mountains*. Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Geograficzne 88: 125-145.

Ustrnul Z, Czekierda D, 2003, *Spatial differentiation of thermal conditions in Poland using GIS* [in Polish]. IMGW, Warszawa, 83 pp.

Tropospheric ozone concentrations in the Carpathians and its effect on plants

Barbara Godzik
Department of Ecology, Institute of Botany, Polish Academy of Sciences, Poland
ibgodzik@ib-pan.krakow.pl

Ground level ozone was monitored during 1997-1999 period in the whole area of Carpathian arch at 26 sites and during 1998-2004 period on both Slovak and Polish side of the Tatra Mountains at 15-25 locatities using combination of passive samplers and active monitors. Ogawa passive samplers provided 2-week averages during growing season (May-September). Active UV monitors (Thermoenvironment 49, 49C) measured O_3 concentration at four sites stored data as 1h averages. Passive samplers data were calibrated against acive monitors. Paralelly with ozone measurement we recorded also concentration of NO_2, SO_2, air temperature and precipitation ammount.

Concentrations of O_3 determined with passive samplers were different between - geographical location of the monitoring stations, monitored periods, and individual monitoring years. In the Carpathians two-weeks ozone concentrations during the period from May 1 and September 30 fluctuated between 35 and 130 mg m^{-3} (1997), 19 and 159 mg m^{-3} (1998), 26 and 179 mg m^{-3} (1999). Values of AOT40 index in the Carpathians were exceeded usually by twice. In the Tatra Mountains the average two-week-long O_3 concentrations ranged from 31 to 200 µg m^{-3}. The average O_3 concentrations for growing season ranged from about 60 to about 120 µg m^{-3}. Ozone concentration was increasing with altitude. Maximum values were recorded on regular, south oriented slopes. According to the active measurements maximum 1-hour O_3 concentrations reached 220 µg m^{-3} (August, 2001) and average monthly O_3 concentrations were close to 100 µg m^{-3}. Results confirmed continuous exceedence of ozone critical loads for forest and occasionally also for human health almost on all evaluated sites. Index AOT40 at the end of season reached the value of 20 000 ppb.h in lower elevations and 50 000 ppb.h above timber-line. Visual symptoms on O_3-related injury were identified on several tree and herbaceous plant species growing in the Carpathians, e. g. *Sorbus aucuparia, Alnus incana, Pinus cembra, Sambucus racemosa, Vaccinium myrtillus, Astrantia major, Centaurea jacea, Alchemilla* sp., *Rumex obtusifolius, Geum rivale, Geranium sylvaticum, Angelica sylvestris* and others.

Tatra Mountains

Spatial characteristics of bark beetle infestations in selected areas in the Carpathians

Wojciech Grodzki
Deptartment of Forest Management in Mountain Regions, Forest Research Institute IBL, Poland
W.Grodzki@ibles.waw.pl

Long-term cooperation with several research institutions dealing with forestry problems in the Carpathians enabled the development of Central European database and map of damage caused by bark beetles in productive Norway spruce *Picea abies* (L.) Karst. forests. As similar threats are present also in many countries where Norway spruce grows in monospecific forest stands, forestry practices in Central European countries follow similar rules and criteria. Availability of digital platforms and similar spatial distribution of forest territorial units allowed us to compare the sanitary cuttings size (infested trees) in particular countries and to delimitate the most threatened, continuous areas in Central Europe (Grodzki, Jachym 2004). At present, extended bark beetle outbreak and related spruce decline should be considered as the main problem in the western part of the Carpathians (Grodzki 2007).

The spruce bark beetle, *Ips typographus* (L.) (Col.: Curculionidae, Scolytinae) is the most serious pest of mature spruce stands throughout Eurasia. The investigations done in 1998-2000 in the Carpathian arch revealed, that in several cases, stands adjacent to sites with higher ozone values were associated with higher bark beetle populations. However, spruce bark beetle dynamics are driven by a complex interaction of biotic and abiotic factors and not by a single parameter such as air pollution (Grodzki et al. 2004).

The effects of intensive versus no management strategies was assessed during an outbreak of *I. typographus* (L.) in 1993-1998 in the Tatra Mts. in Poland and Slovakia. The outbreak has been described in spatio-temporal dimension, and patterns of bark beetle occurrence and dynamics have been defined (Jakuš et al. 2003). In the Slovak portion of the outbreak practices consisted of: no action prior to 1994, intensive pest control management (trap trees, insecticides, salvage cutting) from 1995-1996, active differentiated approach combined with intensive use of pheromone traps from 1997-1998. In Poland, the outbreak was mostly located in reserve areas where pest management or other activities were prohibited. Despite the use of intensive pest management measures, tree mortality was not significantly decreased in the Slovak region during the peak outbreak years of 1995 and 1996. The weather unfavourable for bark beetles led to a rapid decrease in tree mortality in both parts of the study area (Grodzki et al. 2006).

References

Grodzki W, McManus M, Knížek M, Meshkova V, Mihalciuc V, Novotny J, Turčani M, Slobodyan Y, 2004, *Occurrence of spruce bark beetles in forest stands at different levels of air pollution stress*. Environmental Pollution 130/1: 73-83.

Grodzki W, Jachym M, 2004, *Developing a Central European database and map on major forest pests: towards the wider look on forest protection problems.* In: Csóka Gy, Hirka A and Koltay A (eds) *Biotic damage in forests. Proceedings of the IUFRO* (WP7.03.10). Symposium held in Mátrafüred, Hungary, September 12-16, 54-59.

Grodzki W, Jakuš R, Lajzová E, Sitková Z, Mączka T, Škvarenina J, 2006, *Effects of intensive versus no management strategies during an outbreak of the bark beetle Ips typographus (L.) (Col.: Curculionidae, Scolytinae) in the Tatra Mts* in Poland and Slovakia. Ann. For. Sci. 63: 55-61.

Grodzki W, 2007, *Spatio-temporal patterns of the Norway spruce decline in the Western Beskidy mountains in Poland*. J. For. Sci. 53, 38-44.

Jakuš R, Grodzki W, Ježik M, Jachym M, 2003, *Definition of spatial patterns of bark beetle Ips typographus (L.) outbreak spreading in Tatra Mountains (Central Europe), using GIS.* In: M. McManus, A. Liebhold (eds) *Ecology, Survey and Management of Forest Insects*. Proceedings of the conference, USDA Forest Service, GTR NE-311, 25-32.

Development of the Carpathian Ecological Network

Anna Guttova
CERI Bratislava, Slovakia
guttova@daphne.sk

One of the most important objectives of the Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) is the development of an ecological network in the Carpathians as an essential component of the Pan-European Ecological Network. BBI/Matra project „Development of an Ecological Network for the Carpathians" and DBU project "Proposal for Western Carpathian Ecological Network as a precondition for effective cross-border nature protection" support the implementation of the Carpathian Convention in achieving this important objective.

To develop a design of the ecological networ a methodology was developed and consistently applied on the territory of the Carpathians. The steps include:

- refinement of the boundaries of the orographical units
- preparation of the national lists of conservation features – vegetation types (alliances), plant and animal species
- collection of the data on the distribution of habitat types, plant and animal species per orographical unit and more precise occurrence of the priority habitat types, plant and animal species, e.g. minimally 1 locality per orographical unit as point (coordinates) or polygon

  lists of conservation features comprise:

  - 150 habitat types (alliances) based on 133 Carpathian habitats (The Status of the Carpathians 2001), including 115 habitat types linked to Habitat Directive Annex I
  - 216 species, based on 486 Carpathian endemic plants (The Status of the Carpathians 2001), including 42 Habitat Directive Annex II
  - 205 species, based on the list of Carpathian focal animal species (The Status of the Carpathians 2001), including 126 Habitat Directive Annex II
- identification of conservation features (species, habitats and ecological processes) which will be used to define the parameters of the ecological network
- analysis of the factors contributing to the successful conservation of these features (threats and opportunities)
- identification and mapping of social and economic data to design core areas, buffer zones and ecological corridors
- set targets for conservation features (e.g. how many individuals of a selected species should be protected)
- run the computer model to generate draft maps of the proposed ecological network
- wider consultation with key stakeholders to agree on final outputs

More information available on www.carpates.org.

Recent geoecological studies in the Ukrainian Carpathians

Ivan Kruhlov
Department of Physical Geography, Ivan Franko University, Ukraine
ikruhlov@gmail.com

Geoecology deals with a geo-spatial interpretation of interrelations between different biophysical and socioeconomic phenomena in a landscape. Despite relatively long history of ecological and geographical research, the Ukrainian Carpathians were virtually a "white spot" in terms of geo-spatial information until recently. However, during the last three years, to a great extent owing to the availability of free/cheap remote sensing data, the situation has changed.

The project "Natural resources information for the management of national parks in the Polish-Ukrainian boundary region of Bieszczady Mts" (2005-2008) has been carried out by the teams from the Royal Institute of Technology (SE), Ivan Franko University (UA), Wrclaw University (PL) with some data support from the Humboldt University (DE) and financial assistance of the Swedish Institute. Within the project, a dataset of geoecosystems that integrally represents geomorphic, topoclimatic, and vegetation features has been produced using GIS modelling with the 3-arc-second SRTM, Landsat,ETM+, and weather stations' data.

Ecological regionalisation of the whole Ukrainian Carpathians was made using SRTM data in the framework of the CERI project "Development of the Carpathian Ecological Network" (2007-2008) supported by BBI-MATRA (NL). The delineated ecoregions, which are used to map occurrences of the selected vegetation alliances as well as plant and animal species, were also classified with the help of the cluster analysis according to orography properties (mean absolute and relative elevations) and bioclimatic features (areas of altitudinal bioclimatic belts).

Ecological corridors for some umbrella species (inc. bison and bear) will be delineated using newly available geo-data, including landcover, and field studies in the framework of the project "Realising trans-boundary ecological connectivity in the Ukrainian Carpathians" (2008-2010) financed by BBI-MATRA (NL).

Mapping of grassland vegetation and of potentail RAMSAR sites (wetlands) will take place in the framework of another two BBI-Matra projects (2008-2010).

Svidovets

Broadleaved forest reserves facing climate change: scenarios at the lower precipitation forest zone

Katalin Mázsa*, E. Tanács, F. Horváth*, B. Czúcz*, J. Bölöni*, B. Balázs***
**Institute of Ecology and Botany, HAS, Hungary*
***Department of Climatology and Landscape Ecology, University of Szeged, Hungary*
nadragulya@geo.u-szeged.hu

The Hungarian range of the Carpathian Convention is geographically located in Northern Hungary. This is a hilly region mainly with deciduous beech and oak forest cover, as natural or semi-natural vegetation, where in the past few decades, nature conservation had an increased role. In 1991, strictly protected forest reserves were designated supposing that abandonment will promote natural processes. Presently these forest reserves are in a transition state from managed forests towards a spontaneously developed one. Forest reserves, could serve as model sites for long-term forest dynamical studies and modelling of occurrence probability of forest habitats facing climate change.

Canopy forming tree species composition and stand structure changes of an earlier managed but since the 1970's freely developed oak stand (91M0 Pannonian-Balkanic Turkey oak – sessile oak forests) was studied in the Vár-hegy Forest Reserve. The earlier thinning and the spontaneous decline of oaks, mainly *Quercus petraea*, resulted in a more heterogeneous stand structure with a low densities of about 200 oaks /ha. Tree fall gaps were filled in by an early succession tree, *Acer campestre*, and other mixture species (Mázsa et al. 2008).

These lowland forest types face climate change in the near future. The expected impact of climate change on the occurrence probability of beech, oak-hornbeam and sessile oak-turkey oak forest habitat was modelled. Until 2050 probability occurrence will decrease at least by 50 % throughout the lower parts of the present-day distribution of these forest types (Czúcz et al. 2007).

Virgin forest remnants and forest reserves in the Carpathian region are a unique reservoir of natural and cultural heritage from the 19th century. The Carpathian Convention provides a framework for the integrated maintenance and conservation at the regional level of these forest areas of extremely high ecological importance. With respect to these objectives, the Institute of Ecology and Botany (Hungary) initiates/supports

- cooperation in the field of surveying and monitoring biodiversity indicators of forests,
- research on impacts of climate and land use change on natural forests, and
- modelling carbon sequestration and ecosystem services of natural and sustainable managed forests at different climate and land use scenarios.

References

Czúcz B, Kröel-Dulay Gy, Rédei T, Botta-Dukát Z, Molnár Zs (eds), 2007, *Climate change and biological diversity – explorative analysis for a more effective adaptation strategy in Hungary. Research report, manuscript* [in Hungarian with English summary]. Institute of Ecology and Botany of the Hungarian Academy of Sciences, Vácrátót, Hungary.

Mázsa K, Balázs B, Horváth F, Bölöni J, Aszalós R, 2008, *Transition of a managed forest towards a natural one – forest history and stand survey study in an oak forest reserve*. 6th European Conference on Ecological Restoration, 8-12. Sept 2008. Ghent (Belgium) in press.

Land Cover, Land Use and Landscape Changes in the Carpathians: Research of the Department of GIS, Cartography and Remote Sensing, Institute of Geography and Spatial Management, Jagiellonian University

Katarzyna Ostapowicz, Mateusz Troll, Joanna Depta, Dominik Kaim, Natalia Kolecka, Jacek Kozak, Izabela Sitko, Aneta Szablowska-Midor
Institute of Geography and Spatial Management, Jagiellonian University, Poland
kostapowicz@gis.geo.uj.edu.pl

Research activities in the Department of GIS, Cartography and Remote Sensing, Institute of Geography and Spatial Management, Jagiellonian University concentrate on landscape, land use and land cover in the Carpathians (Polish Western and Ukrainian Eastern Carpathians). In 1990s research was focused mainly on forest degradation in the Western Carpathians and its results for landscape changes; currently it deals mostly with land cover and land use change. Landscape change and pattern modeling is also an important research area.

Studies of forest decline (study area: the Silesian Beskid Mts.) were concentrated on forest health detection, assessment of environmental conditions of forest decline and description of the role of deforestation processes in mountain landscapes (Kozak et al. 1999). It was observed that damaged forests occurred more frequently higher up and on slopes facing north and west – looking towards industrial centers in the foreland. The highest degree of forest damage (dead forest, clear-cuts) was detected in the secondary spruce stands, especially on mountain summits. Forest degradation and subsequent clear-cuts resulted frequently in the formation of temporary anthropogenic timberlines, an important component of the Silesian Beskid landscape (e.g. Kozak et al. 1995).

The most important research domain are studies on the past and future land use and land cover (LULC) changes, mainly in the Polish Carpathian Mountains. The Carpathian LULC pattern, composed of a mosaic of crop, pastures, meadows and forests, was the result of a human colonization and an agricultural expansion over several hundreds of years. Currently the following pattern is typical: low proportion of forest cover at the lowest and highest elevations with a maximum in the mid-elevation belt (e.g. Widacki 1989; Troll 2004, Kozak 2005, Kozak et al. 2004, 2007, 2008). The trajectories of LULC changes exhibits an analogy with those observed in many other mountain areas of the world:

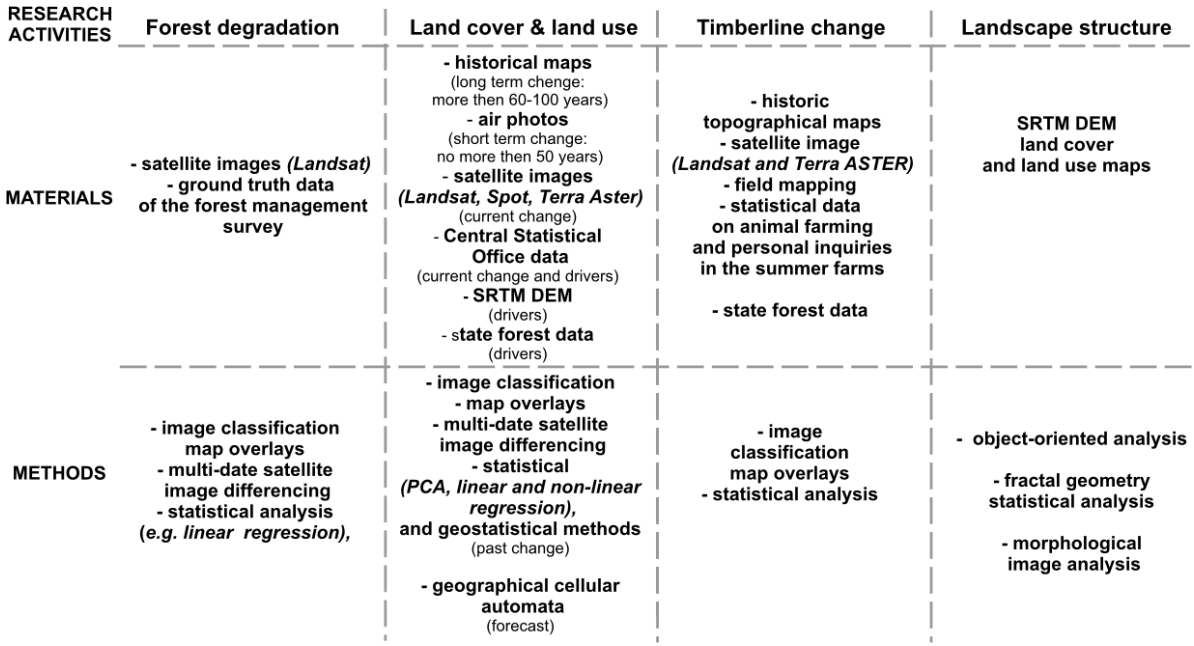


Figure 1. Materials and methods in the studies of the Department of GIS, Cartography and Remote Sensing, Institute of Geography and Spatial Management, Jagiellonian University

dominance of deforestation until the 19th century and afterwards, in the 20th century, a reversal of this trends and slow increase of forest cover. Observed long-term changes and current trends of land cover and land use change are likely to be continued, and may even be intensified in the near future. Underlying drivers: transformation of mountain agriculture (social, economical and technological changes since the 19th century, and political transformation in the region in 1990s), and quite frequently, depopulation of the marginal areas are typical denominators of the observed forest transition.

Agriculture-driven land use changes in the Carpathians were important in the timberline zone. An example could be the Chornohora Mountains (the Ukrainian Carpathians) where an anthropogenic timberline formed as a result of grazing and extensive deforestation (e.g. Sitko, Troll 2008).

The studies of the landscape structure are concentrating on landscape classification , landscape pattern, methods of landscape pattern assessment and the analysis of its drivers (Ostapowicz 2003, Ostapowicz et al. 2008).

References

Kozak J, Troll M, Widacki W, 1999, *Forest degradation* [in Polish with English summary]. In: W. Widacki (ed.) *Przemiany środowiska przyrodniczego zachodniej części Beskidów pod wpływem antropopresji*. Kraków, 33-84.

Kozak J, 2005, *Changes of forest cover in the Polish Carpathians in relation to other mountains of the world* [in Polish with English summary]. Wydawnictwo Uniwersytetu Jagiellońskiego, 135 pp.

Kozak J, Estreguil C, Ostapowicz K, 2008, *European forest cover mapping with high resolution satellite data: The Carpathians case study.* International Journal of Applied Earth Observation and Geoinformation 10, 44-55.

Kozak J, Estreguil C, Troll M, 2007, *Forest cover changes in the northern Carpathians in the 20th century: a slow transition.* Journal of Land Use Science 2: 2, 127-146.

Kozak J, Ostapowicz K, Szablowska-Midor A, Widacki W, 2004, *Land abandonment in the western Beskidy Mts. and its environmental background*. Ekologia (Bratislava) 23, Supplement 1, 116-126.

Kozak J, Troll M, Widacki W, 1995, *The Anthropogenic Upper Treeline in the Silesian Beskid Mts.* Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Geograficzne 98, 199-207.

Ostapowicz K, 2003, *Shape of forest areas in the western part of the Beskidy Mountains* [in Polish]. Czasopismo Geograficzne 74: 4, 313-324.

Ostapowicz K, Vogt P, Riitters K.H, Kozak J, Estreguil C, 2008, *Impact of scale on morphological spatial pattern of forest*. Landscape Ecology 23: 9, 1107-1117.

Sitko I, Troll M, 2008, *Timberline Changes in Relation to Summer Farming – Case Study from the Western Chornohora (Ukrainian Carpathians)*. Mountain Research and Development 28: 3/4, 263-271.

Troll M, 2004, *Application of GIS and. Remote Sensing in land use studies in the western Beskidy Mts.* [in Polish with English summary]. Geoinformatica Polonica 6, 111-121.

Widacki W, 1989, *Relational system of natural environment in the Beskidy Mountains, case study: Jaszczurowa stream in the Beskid Mały* [in Polish]. Habilitation thesis, Jagiellonian University, Kraków, 162, 193 pp.

Deforestation in the Barania Góra region

Changes in the state of the karstic lakes of the Slovak and Aggtelek karst

Andrea Samu
Department of Climatology and Landscape Ecology, University of Szeged, Hungary
samu.andrea@geo.uszeged.hu

Nowadays there are 5 karstic lakes on the Aggtelek and Slovak karst: the Aggteleki-lake, the Vörös-lake, the Kender-lake, the Gyökérréti-lake (Jašteričie jazero) and the Papgödör-lake (Farárova jama). In the past their formation and development were natural. There were also other lakes, which disappeared with time. Their state was changing remarkably over time, firstly as a result of an unforeseen human activity, lately, as the effect of the effort for their rescue. Karstic lakes belong to the natural values of karst. Some are very significant land elements, important as habitat as well as aesthetic attraction. Currently, most of the lakes are strongly eutrophicated. This is the result of change in the traditional karstic land use to the intensive farm production.

The lakes are mentioned already in the early sources, like the First (1784) and Second (1852-5) Military Survey of the Austrian-Hungarian Monarchy (The First... 2006, The Second... 2006), the map of the Baradla cave from Imre Vass (1829), Bartholomeides (1806-1808), Hunfalvy (1863), Dudich (1932).

In this study we addressed in detail only the period since the mid-eighties of the 20th century, when the influence of intensified agriculture could be seen. Due to this factor the biggest lake on the karst plateau the Gyökérréti-lake near Szilice village, started to dry out and nothing could stop it. The same destiny awaited the Aggteleki-lake, where sewage from the surrounding houses had to be also considered. In another part of the village Szilice the Papgödör lake appeared. By the beginning of the 1990's it became strongly eutrophicated because of the animal husbandry. The water of Kender-lake, which might have existed for about 1000 years (Bódisné et al., 2001), was used by iron furnaces and in the 1960's for hemp-soaking.

In the case of Vörös-lake the main problem was water supply, only from precipitation. Because of the road construction the precipitation was led away and the water level decreased. According to Huber (2006) many protected species became extinct during that time (e.g. *Coenagrion scitulum* and *Coenagrion vernale*). In 2001 a dredge was built. The state of the lake has been stabilized, since the National Park built a water-leading system from the road (with an oil-filter included). After that the water levels started to increase and now it is around 1,5-2 m.

The karstic lakes are important land elements. Their appearance and extinction is often equally adaptated to the local and global conditions. The anthropogenic influence made their natural processes much shorter, they extinct, together with some protected species. Moreover they can absorb pollutants and mediate it very fast to the water under the surface and to the caves. This could mean a big danger for them. Therefore it is important, to monitor the lakes state, water chemistry, the algology and the soil. According to the monitoring the most important would be the realization of the handle suggests.

The lakes need the monitoring research in order to reveal the effects of today's land use, erosion and precipitation trends. There is also a need to work out proposals for the lakes management.

Our project aims at the lakes monitoring (water quality, biodiversity, land use, erosion, climate) and describing the causes of the changes. Based on the results we would like to give the recommendations on the conservation of the lakes, important parts of the karstic heritage.

References

Bartholomeides L, 1806-1808, *Inclyti superioris Ungariae comitatus Gömöriensis Notitia historico-geographico-statistica*. Leutschoviae, 784 pp.

Bódisné J. I, Dénes Gy, Jakucs L, 2001, *The landscape of Aggtelek*. In: *Aggtelek a magyar állam alapításának ezredik évében*. Aggtelek Község Önkormányzata, 7-38.

Dudich E, 1932, *The stalactite cave of Aggtelek and its surroundings – Királyi Magyar Természettudományi Társulat Budapest*. (http://mek.oszk.hu/03700/03711/html)

Huber A, 2006, *The rehabilitation of the Vörös-lake by village*, Script.

Hunfalvy J, 1863, *The Description of the Hungarian Empire I*. Pest.

The First Military Survey, 2006, DVD-ROM, Arcanum Adatbázis Kft. Budapest.

The Second Military Survey, 2006, DVD-ROM, Arcanum Adatbázis Kft. Budapest.

Vass I, 1931, *The description of the Baradla-cave*, Pest

Appendix I
List of participants

Baranowski Marek
Institute of Geodesy and Cartography, Warsaw, Poland
marek.baranowski@igik.edu.pl

Bitusik Peter
Matthias Belius University, Banska Bystrica, Slovakia
bitusik@fpv.umb.sk
peter@blatna.cuni.cz

Björnsen Gurung Astrid
Mountain Research Initiative (MRI), Berne, Switzerland
astrid.bjoernsen@uibk.ac.at

Bokwa Anita
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
anita.bokwa@uj.edu.pl

Brzozowska Iwona
Jagiellonian University, Kraków, Poland
brzozowska@adm.uj.edu.pl

Chełmicki Wojciech
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
w.chelmicki@geo.uj.edu.pl

Depta Joanna
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
jdepta@gis.geo.uj.edu.pl

Dragut Lucian
Z_GIS-Centre for Geoinformatics, Salzburg University, Austria
Lucian.Dragut@sbg.ac.at

Elbakidze Marine
Faculty of Geography, Ivan Franko University, Liviv, Ukraine
marine_elbakidze@yahoo.com
marine.elbakidze@smsk.slu.se

Fleischer Peter
Tatry National Park/Tatry Biosphere Reserve, Tatranská Lomnica, Slovakia
fleischer@post.sk

Geyer Juliane
Centre of Nature Conservation, Georg August University Göttingen / Faculty of Forest and Environment, University of Applied Sciences Eberswalde, Germany
juliane-geyer@web.de

Godzik Barbara
Department of Ecology, Institute of Botany, Polish Academy of Sciences, Kraków, Poland
ibgodzik@ib-pan.krakow.pl

Grodzki Wojciech
Deptartment of Forest Management in Mountain Regions, Forest Research Institute IBL, Kraków, Poland
W.Grodzki@ibles.waw.pl

Guttova Anna
CERI Bratislava, Slovakia
guttova@daphne.sk

Halabuk Andrej
Institute of Landscape Ecology, Nitra, Slovakia
andrej.halabuk@savba.sk

Halada Lubos
Institute of Landscape Ecology, Nitra, Slovakia
lubos.halada@savba.sk

Hamkalo Mykhaylo
Department of Tourism, Ivan Franko University, Lviv, Ukraine
kaftour@franko.lviv.ua

Hirschmugl Manuela
Joanneum Research, Graz, Austria
manuela.hirschmugl@joanneum.at

Hoogeveen Ybele
EEA—European Environmental Agency, Copenhagen, Denmark
Bele.hoogeveen@eea.europe.eu

Ibisch Pierre
Faculty of Forest and Environment, University of Applied Sciences Eberswalde, Germany
pibisch@fh-eberswalde.de

Jodłowski Miłosz
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
m.jodlowski@uj.edu.pl

Kadlecik Jan
Department of International Treaties, State Nature Conservancy of the Slovak Republic, Banská Bystrica, Slovakia
kadlecik@sopsr.sk

Kaim Dominik
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
dkaim@gis.geo.uj.edu.pl

Knorn Jan
Geomatics Lab, Geography Department, Humboldt Universität zü Berlin, Germany
jan.knorn@geo.hu-berlin.de

Knutelski Stanislaw
Deptartment of Entomology Jagiellonian University, Kraków, Poland
s.knutelski@uj.edu.pl
knut@zuk.iz.uj.edu.pl

Kolecka Natalia
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
nlis@gis.geo.uj.edu.pl

Kotarba Andrzej
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
andrzej.kotarba@uj.edu.pl

Kotova Lola
Regional Climate Modelling, Max-Planck Institute for Meteorology MPI-M, Hamburg, Germany
lola.kotova@zmaw.de

Kozak Jacek
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
jkozak@gis.geo.uj.edu.pl

Kruhlov Ivan
Department of Physical Geography, Ivan Franko University, Lviv, Ukraine
ikruhlov@gmail.com

Kudla Nazar
Department of Tourism, Ivan Franko University, Lviv, Ukraine
kudlan@wp.pl

Lesiński Jerzy
Department of Forest Botany and Nature Conservation, Agricultural University, Kraków, Poland
jeles@interia.pl
jesinski@ar.kr.pl

Luc Małgorzata
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
mluc@gis.geo.uj.edu.pl

Matei Elena
Prognosis Research Center, Faculty of Geography and Tourism Studies, University of Bucharest, Romania
Matei_ubg@yahoo.com
matei@geo.unibuc.ro

Meessen Heino
CDE outreach, Institute of Geography, University of Berne, Switzerland
heino.meessen@cde.unibe.ch

Mika Miroslaw
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
m.mika@geo.uj.edu.pl

Mikołajczyk Piotr
Environmental Information Centre UNEP/GRID, Warsaw, Poland
piotr@gridw.pl

Mróz Wojciech
Department of Vegetation Conservation, Institute of Nature Conservation, PAS, Kraków, Poland
mroz@iop.krakow.pl

Munteanu Catalina
Institute of Geography, Carpathian Workgroup University of Innsbruck, Austria
Mihaela.Munteanu@uibk.ac.at

Neagu Stefan
Forest Research and Management Institute ICAS, Romania
biometrie@icas.ro

Ostapowicz Katarzyna
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
kostapowicz@gis.geo.uj.edu.pl

Pawlusinski Robert
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
r.pawlusinski@geo.uj.edu.pl

Pietrzak Małgorzata
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
m.pietrzak@geo.uj.edu.pl

Pociask-Karteczka Joanna
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
j.pociask@geo.uj.edu.pl

Samu Andrea
Department of Climatology and Landscape Ecology, University of Szeged, Hungary
samu.andrea@geo.u-szeged.hu

Sandei Pier Carlo
UNEP, Vienna, Austria
PierCarlo.Sandei@unvienna.org

Sitko Izabela
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
isitko@gis.geo.uj.edu.pl

Sobik Mieczyslaw
Department of Climatology, Wroclaw University, Poland
sobikmie@meteo.uni.wroc.pl

Socha Jarosław
Department of Forest Mensuration, Faculty of Forestry, Agricultural University, Kraków, Poland
rlsocha@cyf-kr.edu.pl

Sporka Ferdinand
Department Hydrobiology, Institute of Zoology, Slovak Academy of Sciences, Bratislava, Slovakia
ferdinand.sporka@savba.sk

Svajda Juraj
Institute of High Mountain Biology, University of Zilina, Slovakia
juraj.svajda@uniza.sk

Sylwester Aleksandra
Department of Agricultural Economics and Social Humboldt Universität zü Berlin, Berlin, Germany
a.sylwester@googlemail.com
aleksandrasylwester@yahoo.de

Szablowska-Midor Aneta
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
aszablowska@gis.geo.uj.edu.pl

Szukalska Anna
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
apajak@gis.geo.uj.edu.pl

Szwagrzyk Jerzy
Department of Forest Botany and Nature Conservation, Agricultural University, Kraków, Poland
rlszwagr@cyf-kr.edu.pl

Tanacs Eszter
Department of Climatology and Landscape Ecology, University of Szeged, Hungary
nadragulya@geo.u-szeged.hu

Troll Mateusz
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
mtroll@gis.geo.uj.edu.pl

Tykarski Piotr
Department of Ecology, University of Warsaw, Poland
ptyk@biol.uw.edu.pl

van der Linden Sebastian
Geomatics Lab, Geography Department, Humboldt Universität zü Berlin, Germany
sebastian.linden@geo.hu-berlin.de

Verghelet Mircea
Romanian National Forest Administration, Bucharest, Romania
vmircea@pcral.ro

Verone Wojtaszek Malgorzata
Faculty of Geoinformatics, University of West Hungary
margo@geo.info.hu

Vert Constatin
Department of Geography, West University, Timisoara, Romania
cvert_uvt@yahoo.com

Zagajewski Bogdan
Deptartment of Geoinformatics and Remote Sensing, University of Warsaw, Poland
bogdan@uw.edu.pl

Załuski Bartosz
Institute of Geography and Spatial Management, Jagiellonian University, Kraków, Poland
bzaluski@gis.geo.uj.edu.pl

Zasada Michał
Faculty of Forestry, Warsaw University of Life Sciences — SGGW, Poland
michal.zasada@wl.sggw.pl

Zawilińska Bernadetta
Department of Regional Development, University of Economics in Kraków, Poland
zawilinb@ae.krakow.pl
zawilinb@uek.krakow.pl

Zebisch Marc
EURAC, Bolzano, Italy
marc.zebisch@eurac.edu

Biała Woda Valley

Appendix II

Workshop programme

Tuesday, 27. May 2008

<table>
<tr><td>8.30</td><td colspan="5">Registration</td></tr>
<tr><td>9.00</td><td colspan="5">Workshop Opening
Head of the Institute of Geography and Spatial Management, Jagiellonian University
Dr. Astrid Björnsen Gurung, Mountain Research Initiative, Berne, Switzerland
Dr. Marc Zebisch, EURAC, Bolzano, Italy
Pier Carlo Sandei, Interim Secretariat of the Carpathian Convention, Vienna</td></tr>
<tr><td>9.30</td><td colspan="5">Global Change Research in Mountain Regions
Global context and GLOCHAMORE Research Strategy
Astrid Björnsen Gurung, Mountain Research Initiative
Global Change Research in the Carpathians
Carpathian research of the Institute of Geography and Spatial Management, Jagiellonian University, in the global context
Jacek Kozak, Institute of Geography and Spatial Management, Jagiellonian University
Outline of the biodiversity, ecosystem and land cover research in the Carpathians
Ľuboš Halada, Institute of Landscape Ecology, Slovak Academy of Sciences

Post-Socialist land use change in the Carpathian ecoregion
Sebastian van der Linden, Geomatics Lab, Geography Department, Humboldt-Universität zu Berlin
The importance of a tourism network in the Carpathians
taking the example of tourism trends in the Romanian Carpathians
Elena Matei, University of Bucharest, Faculty of Geography, Tourism Studies and Prognosis Research Center</td></tr>
<tr><td>11.00</td><td colspan="5">Coffee Break</td></tr>
<tr><td>11.30</td><td colspan="5">The Carpathian Science Network, or: where do we come from?
Manuela Hirschmugl, Joanneum Research

Get to know Carpathian colleagues
Astrid Björnsen Gurung, MRI

Expectations towards S4C
Manuela Hirschmugl, Joanneum Research</td></tr>
<tr><td>12.30</td><td colspan="5">Photo shooting</td></tr>
<tr><td>13.00</td><td colspan="5">Lunch</td></tr>
<tr><td>14.00</td><td colspan="5">Developing the Carpathian Research Strategy
Priority setting and available expertise based on questionnaire of the registration form
Marc Zebisch, EURAC, Bozen
Introduction to the working groups</td></tr>
<tr><td>14.30</td><td colspan="5">Thematic Working Groups: The Carpathian Research Strategy</td></tr>
<tr><td></td><td>WG1
Forests & Land Use Change
J. Kozak & B. Zagajewski</td><td>WG2
Climate change & biodiversity conservation
P. Ibisch & W. Mróz</td><td>WG3
Carpathian tourism network
E. Matei</td><td>WG4
Ecosystem services & human wellbeing
M. Elbakidze</td><td>WG5
Carpathian Waters
W. Chełmicki & J. Pociask-Karteczka</td></tr>
<tr><td>15.30</td><td colspan="5">Coffee Break</td></tr>
</table>

16.00	**Thematic Working Groups: The Carpathian Research Strategy**				
	WG1 Forests & Land Use Change *J. Kozak & B. Zagajewski*	WG2 Climate change & biodiversity conservation *P. Ibisch & W. Mróz*	WG3 Carpathian ourism network *E. Matei*	WG4 Ecosystem services & human wellbeing *M. Elbakidze*	WG5 Carpathian Waters *W. Chełmicki & J. Pociask-Karteczka*
17.00 – 18.00	**Developing the Carpathian Research Strategy** Feedback from the Working Groups and discussion				
19.00	Meeting at the Kraków's Market Square				
19.45	Sponsored Conference Dinner *(Na Wawelu Restaurant, Wzgórze Wawelskie [Wawel Hill] 9)*				

Tuesday, 27. May 2008

9.00	**Introduction and commentary of Day I**
9.15	**Potential funding schemes for Carpathian research projects** **EU Framework Programmes** *Iwona Brzozowska, International Programmes Office, Jagiellonian University* Discussion
9.45	**How to organize science in the Carpathian mountains? Examples and experiences** **Research activities in the Carpathians: Current status and expectations towards S4C** *Pier Carlo Sandei, UNEP, Interim Secretariat of the Carpathian Convention, Vienna, Austria* *Ybele Hoogeveen, European Environment Agency, Copenhagen, Denmark* **Negotiating Conservation and Development in a Participatory Process** *Heino Meessen, Centre for Development and Environment, University of Berne, Switzerland* **Carpathian Ecoregion Initiative (CERI)** *Anna Guttova, CERI, Bratislava, Slovakia* **The Carpathian Network of Protected Areas** *Mircea Verghelet, Romanian National Forest Administration, Romania* **Carpathians Environment Outlook (KEO)** *Piotr Mikołajczyk, UNEP/GRID Warsaw, Poland*
11.00	Coffee Break and "Mountain Research Market"
12.00	Closing session