



International Conference

Frontiers in Historical Ecology

August 30 to September 2, 2011
Birmensdorf, Switzerland

Abstracts

Edited by Matthias Bürgi



Swiss Federal Institute for Forest, Snow and Landscape Research WSL

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Aim of the conference

Human activities are important drivers of landscape development and ecosystem change. Consequently, the relevance of considering human impacts has become increasingly popular in ecology over the past decades. Historical ecology has been promoted as an integrative approach for the study of human impacts on ecosystems and landscapes over time and as a prerequisite to understand current day ecosystems and landscapes. At this conference, we strive to determine promising new developments in methodological diversity and interdisciplinary challenges in historical ecology.

Session topics

We define major frontiers in historical ecology, being the topics of four consecutive sessions.

Session A: Relevance of historical information in times of global change

Organizer and keynote: David J. Mladenoff, University of Wisconsin-Madison, USA

How much does global change put the relevance of historical information into question? Is it of any use to analyze the past, if the future will most likely be dramatically different? In this session, we look at corresponding questions regarding science and application, and we determine main fields in land change science / global change research where we anticipate relevant contributions of historical ecology.

Session B: Beyond case studies in historical ecology – the search for general patterns of ecosystem change

Organizer: Martin Hermy, Katholieke Universiteit Leuven, Belgium

Keynote: Sara A.O. Cousins, Stockholm University, Sweden

There is discrepancy between the large number of case-studies and the limited efforts to generate general insights on the interconnectedness of societies and their environment. The search for general patterns and processes of ecosystem change is not an easy task, as many studies in historical ecology have spatial and temporal constraints. Furthermore, studies have to meet scientific standards and, at the same time, be valuable for ecosystem planning and management. This session includes examples of integrated and applied historical ecology studies, which discuss how they contribute to search for general patterns and processes of ecosystem change.

Session C: Historical ecology and ecosystem modeling

Organizers: Harald Bugmann, ETH Zurich, Switzerland / Urs Gimmi, WSL, Switzerland

Keynote: Peter H. Verburg, VU University Amsterdam, The Netherlands

Historical ecologists tend to underline the importance of their research for ecosystem modeling. But what are the prerequisites for successfully integrating historical data in ecosystem models? What does historical ecology gain from integrating modeling approaches?

Session D: Problems and possibilities on the border between historical ecology and environmental history/archaeology

Organizer: Lars Östlund, SLU Umeå, Sweden

Keynote: Nancy Langston, University of Wisconsin-Madison, USA

How do ecologists use, for example, historic sources, and how is source criticism perceived among ecologists? Are there good examples of cross-disciplinary collaboration, and when does this work out and when does it fail? This session starts from the historical ecologist point of view and examines examples of successful collaboration and methodological innovations across disciplinary boundaries.

Conference Program – Talks

Tuesday, 30 August 2011

09:00 Registration/Coffee in Foyer

10:30 Opening plenary

Welcoming address by Rolf Holderegger, WSL, Switzerland

Introduction and administrative information by Matthias Bürgi, WSL, Switzerland

11:15 Lunch in “Kantine”

12:00 Coffee in Posterroom (“Lagerhalle”)

12:30–16:00 Session A: Relevance of historical information in times of global change

Organizer: David J. Mladenoff, University of Wisconsin-Madison, USA

Chair: Ian Rotherham, Sheffield Hallam University, UK

12:30 Keynote A: How can legacies and lessons of the past be relevant in a changing future?

David J. Mladenoff, University of Wisconsin-Madison, USA

13:10 TA1: The impact of historical land clearing on North American coastal wetland formation and its implication for modern day marsh survival under modern sediment delivery rates and global change effects

Glenn Guntenspergen, United States Geological Survey, Laurel, USA

13:30 TA2: Use of historical information to guide future conservation actions in woodland reserves

Peter G. Spooner, Charles Sturt University, Albury, Australia

13:50 TA3: Surveying autochthonous woody plants and producing planting stock: a continuity of local genetic diversity as alternative to import of foreign provenances

Kristine Vander Mijnsbrugge, Research Institute for Nature and Forest, Belgium

14:10 Coffee in Posterroom (“Lagerhalle”)

14:40 TA4: The relevance of history to climate change adaptation: using historical ecology to design diverse, resilient landscapes

Robin Grossinger, San Francisco Estuary Institute, USA

15:00 TA5: A historical perspective on how landscape context may influence the response of vegetation to climate change

Sara Hotchkiss, University of Wisconsin-Madison, USA

15:20 TA6: Using palaeoecological proxies such as pollen and geochemistry of lake sediment and peat to shed light on environment history

Ulf Segerström, SLU Umeå, Sweden

15:40 Final discussion Session A

16:15 Celebration 50th Anniversary IUFRO Forest History Group

Organizer: Mauro Agnoletti, University of Florence, Italy

16:20 50 Years IUFRO Group Forest History: Topics – Meetings – People

Anton Schuler, Zurich, Switzerland

16:40 Towards Rio + 20: The contribution of forest history to sustainable development

Mauro Agnoletti, University of Florence, Italy

17:00 Reception in front of Posterroom or in “Kantine” (depending on weather)

Wednesday, 31 August 2011

8:00 Coffee in Foyer

8:30–12:20 Session B: Beyond case studies in historical ecology – the search for general patterns of ecosystem change

Organizer and Chair: Martin Hermy, Katholieke Universiteit Leuven, Belgium

8:30 Keynote B: Using landscape history to understand present ecological patterns and processes

Sara A.O. Cousins, Stockholm University, Sweden

9:10 TB1: Predictability and change in Wisconsin (USA) plant communities since 1950

David A. Rogers, University of Wisconsin-Parkside, USA

9:30 TB2: Comparative historical ecology of trans-atlantic mountain landscapes

Ted Gragson, University of Georgia, Athens, USA

9:50 TB3: The summit rush of plants and botanists

Veronika Stöckli, WSL Institute for Snow and Avalanche Research, Switzerland

14:10 Coffee in Posterroom ("Lagerhalle")

10:40 TB4: 2000 years of plant successions in an old Mediterranean grassland: will the Roman finger-print disappear one day?

Thierry Dutoit, Avignon University, France

11:00 TB5: Large scale impact of Roman agriculture revealed by LIDAR remote sensing in present day forests

Jean-Luc Dupouey, INRA-Nancy University, France

11:20 TB6: Historical land-use as long-term forest dynamics driver in European Russia

Maxim Bobrovsky, Institute of Physico-Chemical and Biological Problems in Soil Science of RAS, Russia

11:40 TB7: The creation of species pools in cultural landscapes: natural community analogs, niche construction and niche shifts

Ove Eriksson, Stockholm University, Sweden

12:00 Final discussion Session B

12:20 Lunch in "Kantine"

12:45 Coffee in Posterroom ("Lagerhalle")

13:15–14:30 Poster Session (all uneven numbers) in Posterroom ("Lagerhalle")**14:30–18:00 Session C: Historical ecology and ecosystem modeling**

Organizers and Chairs: Harald Bugmann, ETH Zurich, Switzerland; Urs Gimmi, WSL, Switzerland

14:30 Keynote C: Historical land use and ecological modeling: from land use reconstructions to ecosystem dynamics

Peter H. Verburg, VU University Amsterdam, The Netherlands.

15:10 TC1: Modelling earlier forest landscapes by combining forest inventory data with historical maps and other geographic information

Anna-Lena Axelsson, SLU Umeå, Sweden

15:30 TC2: Forest cover changes in the Polish Carpathians in the last 150 years

Krzysztof Ostafin, Jagiellonian University, Poland

15:50 TC3: Land use history and environmental gradients as driving factors of subalpine *Larix decidua* forests: a watershed-scale analysis

Matteo Garbarino, University of Torino, Italy

16:10	Coffee in Posterroom ("Lagerhalle")
16:40	TC4: Modeling effects of historic forest litter raking on forest soil carbon pools Benjamin Poulter, Laboratoire des Sciences du Climat et L'Environnement (LSCE), France
17:00	TC5: Separating human and climatic impacts on Mediterranean forests during the Holocene with paleoecology and dynamic modeling Paul D. Henne, University of Berne, Switzerland
17:20	TC6: Modelling soil carbon dynamics under historical land-use in European Russia Maxim Bobrovsky, Institute of Physico-Chemical and Biological Problems in Soil Science of RAS, Russia
17:40	Final discussion Session C

Thursday, 1 September 2011

8:00 Coffee in Foyer

8:30–12:20	Session D: Problems and possibilities on the border between historical ecology and environmental history/archaeology Organizer and Chair: Lars Östlund, SLU Umeå, Sweden
8:30	Keynote D: More than chronology: What can environmental historians offer on the frontiers of historical ecology? Nancy Langston, University of Wisconsin-Madison, USA
9:10	TD1: The pleasure of kin: convergent lineages in historical ecology Carole L. Crumley, Stockholm University, Sweden
9:30	TD2: The pre-1800 dilemma: How to deal with early written sources in historical ecology Péter Szabó, Institute of Botany, Academy of Sciences of the Czech Republic, Czech Republic
9:50	TD3: Legacies of pre-Colombus activities in the landscapes and biodiversity patterns of French Guyana Etienne Dambrine, INRA-University of Savoie, France

10:10 Coffee in Posterroom ("Lagerhalle")

10:40	TD4: A (pre)historic ecology of a high altitude alpine landscape: The Bronze Age to Roman Period in the Southern French Alps Kevin Walsh, University of York, UK
11:00	TD5: New insights into the ancient woodland paradigm Ian D. Rotherham, Sheffield Hallam University, UK
11:20	TD6: New insights from comparing 18th century and current vegetation patterns Emily W.B. Southgate (Russell), Hood College, USA
11:40	TD7: Quantifying human land use – Sami settlement and movement patterns in northern Sweden before 1900 Torbjörn Josefsson, Umeå University, Sweden
12:00	Final discussion Session B

12:20 Lunch in "Kantine"

13:00 Coffee in Posterroom ("Lagerhalle")

13:30–15:30 Poster Session (all even numbers) in Posterroom (“Lagerhalle”)

15:30 Closing plenary

16:45 Departure to conference dinner

18:00 Conference dinner at Weingut Rütihof, Uerikon

Friday, 2 September 2011

Excursions

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Session A

Relevance of historical information in times of global change

Organizer and keynote: David J. Mladenoff, University of Wisconsin-Madison, USA

How can legacies and lessons of the past be relevant in a changing future?

David J. Mladenoff

University of Wisconsin-Madison, Wisconsin, USA

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In recent years historical ecology has surged in its development, and we are continually gaining knowledge and appreciation of the legacies of past events on current systems. It is ironic that this development is occurring in tandem with a clear future of significant global change, which will drive ecosystems in ways we can only begin to understand. Direct climate changes are the obvious ones, but there are likely to be other aspects of global change in the future prompting new ecosystem trajectories. These include indirect effects of climate change, such as pests and disease outbreaks and other disturbance regime alterations, such as wind and fire. Unprecedented human population levels and demands for products and services from ecosystems will also be significant. Management of forests under the concept of historical range of variability has become a common objective and framework. But with the prospect of changes described above, is there value to historical data and information? If yes, are there caveats we should make explicit for the use of such information? I will attempt to set the stage for our session by exploring these ideas and concerns.

The impact of historical land clearing on North American coastal wetland formation and its implication for modern day marsh survival under modern sediment delivery rates and global change effects

Glenn Guntenspergen and Matthew Kirwan

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Keywords: coastal wetlands, sediment, land clearing, models, ecogeomorphic

Recent developments in coastal marsh simulation modeling that are used to predict the survival of coastal wetlands under global change raises the possibility that extensive marshes that are degrading today were stable ecosystems during periods of high sediment delivery. Modern coastal wetland survival in the face of increases in sea-level rise strongly depends on sediment availability. Stratigraphic analysis in the Plum Island Estuary (Massachusetts) suggests that salt marshes expanded rapidly during the 18th and 19th centuries due to increased rates of sediment delivery following deforestation associated with European settlement. Numerical modeling emphasizes that existing marshland could survive, but not form under the low suspended sediment concentrations observed in the estuary today. These results suggest that many of the expansive marshes that characterize the modern North American coast are metastable relicts of high 19th century sediment delivery rates, and that recent observations of degradation may represent a slow return to pre-settlement marsh condition. Our results emphasize that predicting the response of ecosystems to climate change requires consideration of the legacy effects of historical land-use as well as predictive numerical simulation models that incorporate ecogeomorphic feedbacks. Management efforts to restore coastal wetlands may actually prevent some systems from returning to a “natural” state.

Use of historical information to guide future conservation actions in woodland reserves

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Keywords: grazing, long-term data, Travelling Stock Reserve

Globally, agricultural landscapes contain remnant ecosystems which have evolved from different historical management regimes, economies and political policies. By detailing the history of human activity and resulting changes in vegetation structure, composition and pattern, we can examine biotic responses to novel anthropogenic disturbance processes, and devise appropriate conservation strategies under future climate change scenarios.

Historical ecology is a relatively new paradigm in which ecologists view ecosystems as historically and spatially influenced non-equilibrium systems that are complex and open to human inputs. Building on disturbance ecology, a historical ecology framework recognises that landscape elements may have evolved with human inputs to such an extent that abandonment of human interference may lead to impoverishment of structural and biological diversity. This framework recognises that historical events play a major role in past, present and future conditions, as changes in abiotic properties or species composition that happened in the past can have large and often irreversible effects on the structure and dynamics of present day ecosystems.

The aim of this paper is to highlight the critical importance of historical information to inform future conservation management activities, by using a case-study in south-eastern Australia. Here, a network of small Travelling Stock Reserves (TSRs) historically managed for domestic stock purposes (>170 years), are the target for investment in conservation management actions to conserve endangered woodland species, and in turn, strengthen landscape resilience to climate change. I will discuss how long-term grazing data has been used to better understand historic grazing legacies on vegetation conditions, and guide future conservation planning endeavours.

Surveying autochthonous woody plants and producing planting stock: a continuity of local genetic diversity as alternative to import of foreign provenances

Kristine Vander Mijnsbrugge¹, Arnout Zwaenepoel², Bart Opstaele³ and Bert Maes⁴

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Keywords: autochtony, inventory, old growth forest, planting stock, seed collection, seed orchard

Autochthonous woody plants are descendants from populations that colonised our area after the last glaciation. During thousands of years of natural selection they adapted to the local growth conditions. Remnants today thus represent a genetic continuity and form an intrinsic part of the biodiversity. An inventory survey locating remaining autochthonous populations in Flanders ran from 1997 till 2008. Old growth forests and ancient woodlands (continuous forest cover on historical maps starting from the Ferraris map in 1775) were visited in the field. On the spot, criteria such as relicts of old forest management techniques (e.g. coppice), age of the trees and shrubs, presence of herbaceous vegetation indicating old growth forest conditions and absence of big disturbance all contribute to an autochthonous quotation. The results of this inventory are apparent: autochthonous woody plants in Flanders have become seriously endangered. This result is most probably true for many north western European countries. Evident reasons are the particularly low and fragmented forest cover, centuries of intensive forest use in this highly populated area and scale enlargement in rural areas (disappearance of tree rows, wooded banks, old hedges and small farmer's forests). Another less obvious reason is the wide-spread usage of non autochthonous planting stock (indigenous species but seeds collected in low wage European countries) in reforestation and landscape plantings. Intraspecific hybridisation between remnant autochthonous populations and foreign genotypes, which can show inadequate adaptation, may influence the autochthonous genetic constitution and fitness in the long term. It is a major concern for nature conservation to protect and promote autochthonous genetic resources of woody plants. The Flemish forest administration, together with several partners, therefore run programs on the production of autochthonous planting stock by collecting seed in situ and creating seed orchards.

The relevance of history to climate change adaptation: using historical ecology to design diverse, resilient landscapes

Robin Grossinger, Erin Beller, Ruth Askevold and Julie Beagle

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Keywords: historical ecology, climate change, California, Mediterranean climate, coastal habitats

Projections of future climate scenarios in California suggest the likelihood of greater frequency and/or severity of floods, droughts, and high temperature extremes. Such anticipated shifts in climatic drivers raise questions of the relevance of information about how landscapes functioned in the recent historical past. Detailed, extensive local studies on the historical ecology of coastal California watersheds, conducted over the past 18 years, suggest that a strong regional understanding of historical ecological and hydrogeomorphic patterns will be a valuable tool for ecosystem management in a time of global change.

We explore three aspects of historical ecology's relevance in informing climate-adaptive management strategies: (1) heterogeneous local landscapes, (2) habitat resilience through diversity, and (3) climate-indexed ecological gradients. First, historical ecology reveals forgotten aspects of local landscapes, including (in California) semi-arid habitats that were well adapted to low/variable rainfall and could be appropriate models for future environmental management with shifts in local climate. Second, the historical landscape shows how local landscapes naturally provided diverse ecological functions while still buffering extreme seasonal and inter-annual climatic variability. This information provides templates for restoring landscape complexity along existing and projected future physical gradients, increasing the ability of systems to adapt over time. Third, landscape-scale historical research allows us to develop climate-indexed conceptual models that take into account the variability of local ecosystems across broad climatic gradients, suggesting proactive strategies for restoration and management. History, far from being irrelevant in a time of climate change, reveals a resilient, heterogeneous landscape that suggests new strategies for designing a climate-adaptive future.

A historical perspective on how landscape context may influence the response of vegetation to climate change

Sara Hotchkiss¹, Randy Calcote², Beth Lynch³ and Michael Tweiten¹

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Keywords: landscape, vegetation, fire, climate, paleoecology

This project uses landscape history to study whether small variations in soil texture influence the response of local vegetation and disturbance regimes to climate change. We focus on the northwestern Wisconsin sand plain, a 450 000 ha area of sandy glacial outwash soils. The Public Land Survey, which was completed in the middle 1800s in this region and is often used as a baseline for restoration efforts, showed this landscape supporting forests of *Pinus resinosa*, *P. banksiana*, and *P. strobus*; forests, woodlands, and barrens dominated by *P. banksiana*, and savannas with *Quercus* and *Pinus* species. Paleoecological records from small, deep lakes have been calibrated to reveal heterogeneity of vegetation and fire regimes on spatial scales of 5–10 km. We measured the degree of change of vegetation with ordinations of pollen assemblages, and the rate of change using a multivariate distance between pollen assemblages at 50-year increments. Charcoal accumulation rates and the frequencies of charcoal peaks likely to represent local fire events were analyzed to develop histories of fire regimes.

Records of the past 4000 years from several sites within a few km show some regional consistency, with a decrease in *Quercus* pollen percentages and the magnitude of charcoal peaks ~3000–2500 years ago, consistent with regional change to cooler/wetter conditions. *Quercus* pollen decreases further beginning ~1500 BP, as *Pinus resinosa/banksiana*-type pollen increases. *Pinus strobus* increases and charcoal accumulation rates generally decrease with increasing moisture about 600 years ago, but the timing of changes in vegetation and disturbance regime is heterogeneous at a more local landscape scale. Results indicate that vegetation on the most xeric (driest) soils with the coarsest sand has been least sensitive to past climate changes, perhaps due to strong vegetation-fire feedbacks, while vegetation on slightly less xeric sands in the southern part of the landscape has changed more over the past few thousand years. We conclude that even small variations in soil texture play an important role in determining the stability of vegetation and fire regimes in response to climatic changes.

Using palaeoecological proxies such as pollen and geochemistry of lake sediment and peat to shed light on environment history

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Keywords: pollen, geochemistry, lake sediment, settlement, environment history

Environmental planning and management requires insights into the long-term dynamics of nature and the role that human activities in the past have played for the current condition of landscape and the natural environment in general. The natural dynamics of nature in pace with climate change, and environmental changes induced by human activities act over decadal and centennial time-scales and must be studied in a historical perspective. By using paleoecological tools such as biological and geochemical analyses of lake sediments and peat deposits we may increase our understanding of ecosystem changes and provide the long-term historical perspective that is beneficial to current environmental assessment work and the management of nature reserves. As an illustration of the long-term dynamics of nature and the role of man we present and discuss a number of case studies from Sweden concerning large-scale atmospheric pollution, lake acidification, lake eutrophication, vegetation and nature conservation.

Posters Session A

Traditional ecological knowledge – a vanishing source of information for historical ecology and nature conservation management

Zsolt Molnár¹ and Dániel Babai²

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Keywords: salt steppe, pasturing, Hungary, mountain hay meadows, Romania

Introduction and goals: Historical ecology, and conservation biology in Europe surprisingly rarely take advantage of the traditional ecological knowledge of peasants, though nature conservation has a serious shortage in adequate information and traditional knowledge has already proved its relevance in the development of old-new nature conservation management.

Methods: Data were collected on the knowledge on plants, vegetation types and dynamics in two landscapes: herdsman (62 people), and Tschangow peasants (52 people).

Results: Herdsmen distinguish all habitats of the salt steppe, and name ca. 55% of their plant species. Unexpectedly more than 90% of their knowledge is independent of European scientific knowledge. Their knowledge is not rarely more detailed (e.g. changes in the quality of pastures, and grazing methods, effects of the increasing reed and litter cover). Oddly, herding is a necessary malady for conservationists, because grazing is required to the maintenance of the steppe, but the behaviour of herdsman is often difficult to influence.

In the Eastern Carpathians 172 plant taxa, and 132(!) habitat types, and seven stages of clear-cut succession are distinguished. Traditional grassland management is still in use (reason: communist period followed by poverty). Key factors mentioned most often to maintain hay quality of the highly diverse mountain meadows are the followings: remove ant/mouse hills, stones/twigs, meadows must be cut every year, natural seed production (important for local regeneration!) and hay production should be optimized (different parcels of the meadows of a family are mown first and last in each year), and overseeding with *Onobrychis* and diverse seed mixtures collected from the barn. Natura 2000 management plan of the area was developed based on the local knowledge collected by our group.

Conclusions: Results may improve not only our knowledge, but also the communication of local and non-local people, and can form the basis for local school curricula.

Shifting household economic strategies and pastoral fire: long term human fire ecology in the French Western Pyrenees

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Keywords: historical ecology, pastoral fire, Pyrenees Mountains, household land use, dendroecology, traditional fire management

Pastoral fire-use is thought to have had significant, longterm impacts on the landscape of the Pyrenean Mountains. Over the last century land use change and a concomitant decline of traditional fire management in the Pyrenees and other mountain ranges have shifted landscape fires away from relatively patchy, high frequency, low intensity regimes to larger, more destructive, and less predictable high intensity regimes. These changes present concerns and challenges for environmental conservation and human vulnerability. The immediate threat is to life and property, but long-term effects of high intensity fires contribute to biodiversity loss, degraded watershed functions, and global climate change. Land management practices such as pastoral fire that serve to control fire severity may help shape landscape mosaics that are more conducive to long-term conservation goals. Despite considerable land use changes over the last century, Basque farmers in the French Western Pyrenees continue to use fire in their annual land management repertoire. However the historical ecology of pastoral fire is poorly understood due to lack of unbiased written records as well as methodological constraints concerning the resolution of sedimentary charcoal records. This paper presents research that combines dendroecological and historical landscape analysis with ethnohistorical accounts of household land use and fire practices as an alternative route to understanding the historical ecology of fire-use in the Pyrenees. Explaining the long term interaction of social and ecological processes in landscapes shaped by pastoral fire can provide important insights for local to global scale conservation related decisions and policies.

The utility of historical records for determining changes in fire regimes. Historical wildland fires in the Guadiato Valley (Cordova)

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Keywords: Cordova, wildland fires, fire regimes, forest landscape, land management, risks, Spain, Mediterranean areas.

The frequency and magnitude of wildland fires increased significantly in the Mediterranean area during the last forty years, prompting the appearance of new risk territories and fire regimes. Recent statistical data provide accurate information about wildfires but in order to understand future fire behaviour in the context of global change further knowledge of the historical evolution of wildfires is necessary.

The Guadiato Valley (Cordova, Southern Spain) appeared as a suitable study area, for it features typical Mediterranean conditions and landscapes. Also, statistical data showed it has been largely affected by wildfires in the last four decades.

The main aims of the research were (i) obtaining deeper knowledge of the natural history of Mediterranean forests; (ii) reconstructing the historical records of wildland fires in a particularly vulnerable area; and (iii) analysing the influence of fire on the evolution of forest landscapes.

Historical documents, bibliographic sources, and palaeoecological data were used, and field work was carried out as well. These provided information about forests and fire activity during the the Holocene and a database of historical wildfires in the study area between 1820 and 1935 could be built. It was then compared with the statistical data (1969–2007) in order to identify changes in the structure and composition of forests and in fire regimes and to determine the links between fire, human activities and landscape evolution during the last two centuries.

The results showed that fire is not a recent phenomenon in the study area, neither as a tool for land management nor as a risk factor. Besides, changes in fire regimes appeared to be highly influenced by human activities and their evolution.

This research method could be carried out in other territories in order to complete and compare results, thus obtaining information that could result very valuable to feed simulation models for making better predictions of future fire scenarios.

The role of management in the establishment of European oakwoods

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Keywords: oakwoods, lowlands, management, palynology, history

The origins and continuity of European lowland oakwoods have been intensely discussed recently. Oakwoods during the Holocene are described by two contrasting views either as natural communities, relicts of the Holocene climatic optimum, or as anthropogenic communities sustained by different types of management (wood-pasture, coppicing, etc). The aim of our study was to elucidate the driving factors behind the occurrence of continental oakwoods in the Pannonian Basin. Based on the results of interdisciplinary palaeoecological and historical research from Dúbrava (literally: Oakwood) near Hodonín, SE Czech Republic, we reconstructed the history of the past 2000 years at this site. Palynological data obtained from two forest hollows situated within the forest were compared with archival documents. The C14 calibrated palynological data identified two major shifts in the development of vegetation. The first is dated to the middle of the 14th century, the second to the first half of the 19th century. The first event showed an abrupt increase of *Quercus* and a marked decline of the formerly prevailing *Corylus*. This event could be exactly linked with the historical data. Two mid-14th-century documents mentioned the introduction of the protection of oaks in Dúbrava. Interestingly, the historical name of Dúbrava was Klečka meaning “scrub” or “shrub”, arguably referring to the then prevailing *Corylus* growths. The second major change also correlates with what we know from historical documents. In the 19th century, modern forestry started massive *Pinus* plantations in Dúbrava. We conclude that continental oakwoods need not be “natural” or “relict” communities. In our example, the present day oakwood probably originated by selective management in the 14th century.

Ground-based repeat photography in long-term land use and land cover change analysis – case study from the Carpathians

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Keywords: repeat photography, land use and cover change, the Carpathians

Repeat photography is a valuable method of analysing long-term land use and land cover changes (LUCC), especially in mountain areas. However due to several limitations, a combination of different methods is required to extract LUCC information from terrestrial photography.

In this paper, LUCC were analysed in the Pieniny Mountains (northern Carpathians) using repeat photography. Process of data acquisition, methods and qualitative and quantitative results are presented.

From the hundreds of historical photos available in regional museums, archives publications and private collections less than 50 taken between 1890 and 1975 were selected and only 32 photographs were successfully located and re-photographed between 2008 and 2011. In the next step, qualitative analysis of land use changes was carried out based on interpretation of agricultural features, forests, settlements and infrastructure on the pairs of photographs. The last step – quantitative analysis was based on a grid overlaid on old and contemporary images. To analyse LUCC, map algebra methods were used.

A significant increase in forest cover combined with the decrease of agricultural lands was found in the study area, likely due to land abandonment and natural succession. The repeat photographs showed also the decreasing role of sheep grazing, which used to be an important part of the local economy. On the other hand, development of settlement areas was identified, understood both as an increase in the density of buildings and sprawl of built-up areas.

The repeat photography offered a new perspective and hence new insights into long-term land change studies. As compared to the analysis of historical maps or remote sensing data it is however much more time consuming and suitable rather for the qualitative analysis.

Impact of previous land use on biodiversity of bryophytes in woodland key habitats

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Keywords: woodland key habitats, special species, forest management, North Vidzeme Biosphere Reserve

Woodland key habitats are areas that are considered to have attained a high level of naturalness, which is estimated by amounts of structural elements and presence of specialist species. However, very little is known about the history of land use in these forests and its relationship with biodiversity.

The North Vidzeme Biosphere Reserve of Latvia has a total area of 4, 576 km². This large territory is represented by landscape with forests and it includes woodland key habitats. The aim of the work was to determine the land use of woodland key habitats in the North Vidzeme Biosphere Reserve of Latvia. We examined the effect of forest stand age and management intensity on epiphytic and epixylic biodiversity.

In total, 12 study sites were chosen from broad-leaved tree and alder swamp forest types. Plots of size 20x50 m were established in the selected stands. In each forest forest structure was described. Epiphytic and epixylic bryophyte richness were determined. The data obtained about the forest use and age structure for all the study plots was obtained from archive materials stored in the Latvian State Forest Research Institute "Silava" and from the Forest Register of the State Forest Service. The analysed period for the forest use was from 1940 until today. This data allowed to compare woodland key habitats based on structural elements, species richness, and past forest management. Age of the stand had little effect on biological diversity. The most important factors explaining high diversity of specialist species were the presence of structural elements and a low intensity of past management. The presence of woodland key habitat specialist species can be attained in deciduous wood that have reached 70 years, or even less, since past harvest.

200 years of forest cover changes in relation to soils: case studies from NE Germany and SW Poland

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Keywords: afforestation, ancient forest, deforestation, forest history, recent forest

Central Europe is a well-known landscape extensively altered by humans since some 1000 years. As consequence, the forest cover has declined in many European countries to one-third or less of its original cover. Actual forest-open land patterns are the result of a mutual relationship between various environmental and socioeconomic factors. Intuitively, forest ecologists assumed that recent forest areas have remained on unproductive soils or soils not effectively usable for agriculture, e.g. sandy soils with low nutrient-level, over-damp soils, too damp to be easily cultivated without permanent amelioration and drainage, or areas with steep slopes. In fact, studies on long-term changes of forest-open land patterns related to environmental conditions are rare. Limitation of reliable historical maps and very time-consuming work to prepare them for intersection with actual maps is the main reason for this lack. Therefore, we created digital maps of forest-open land distribution for the time slices ca. 1780, 1880 and 1980/1990 for different regions in NE Germany and in SW Poland. Fortunately, we could use the same historical maps for all regions, and thus, we had no need to overcome the problem of different legends at these times. The earliest map was the Schmettau map (1767–1787, scale 1:50 000). About 100 years later the Prussian Government (1877–1915) ordered to produce exact topographical maps at scale 1:25 000.

The size of the investigated regions varies from 732 km² to 4430 km², and their current forest cover ranges from 23% to 41%. The forest-open land maps were intersected with soil maps to address two main questions:

- (i) Are there any general patterns of long-term forest-open land changes in all regions observed?
- (ii) Are changes of long-term forest-open land patterns related to soils? If so, was there any general tendency in choosing the sites for deforestation which were occurring on rich, fertile soils?

Historical reconstruction of the disturbance regime in a mountain spruce forest landscape

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Keywords: history, forest, wind, bark beetle, spruce, aerial photography

Large areas of temperate mountain spruce forests in Central Europe in National parks Sumava and Bavarian Forest were disturbed by wind throw and bark beetle outbreaks during last two decades. It may seem as a result of ever raising human impact in this area, like recent extensive clear cutting and reforestation practices, or outcome of global change by means of more wind throws, higher drought stress or lower resistance to pathogens. However, there is historical evidence of major wind throws in last centuries followed by bark beetle outbreaks, similar to ongoing one. It indicates that such disturbances may as well be within the historical range of variability (HRV) of forest dynamics.

We have focused on historical forest maps and inventories from 19th century and combined it with analysis of aerial photographs from last 50 years. It allowed us to unravel detailed information about ongoing processes, which are missing in the historical maps, or their interpretation is unclear.

Historical maps of wind throws in 1862–1873 show, that the old grown forests without human impact were the most disturbed, and generally younger managed stands suffered much less. Thorough examination uncovers large parts of natural forests of the same age, suggesting even older wind throws corresponding with written evidence of severe windstorms in 18th century. In contrast, analysis of aerial photographs shows that management practices in last 30 years triggered large-scale forest fragmentation or even deforestation. There is lack of dead wood (standing and fallen) in these areas and natural regeneration is slow, blocked by grasses, drought or extreme temperatures during the year due to modified microclimate.

Reasonable management plan in this area is only achievable by landscape scale modelling based on historical data, which may help to define practices fitting in the HRV.

Study of historical land-use permanences as indicator of integrity in cultural landscape. The case of Monferrato (South Piedmont, Italy)

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Keywords: landscape changes, cadastral maps, aerial photo, agroecosystem, UNESCO

Identity, integrity and authenticity are considered priorities for the inscription in the World Heritage List by UNESCO. Moreover, they are all essential both for ensuring the quality of the analyses employed on the cultural heritage properties during the nomination iter and, afterwards, for the success of the management phase. These conditions are not easy to verify in a cultural landscape, deeply modified by human actions. The identification of historical land-use permanences could be considered an indicator of integrity and a source of useful information for cultural landscape planning. Therefore, with the aim to recognize traditional forms of land-use, and the historical permanences, a detailed historical research was performed. The study area was the Monferrato, an hilly vineyard cultivated agroecosystem, located in South Piedmont (Italy), candidate, together with Langhe and Roero, to become UNESCO cultural heritage for its peculiar landscape. The purpose of the research was to analyse and quantify the landscape changes starting from historical documents. In particular, archive materials, historical and cadastral maps were compared with aerial photographs and other available sources. The landscape changes were analysed from the XVI Century to understand the existence of permanences and, consequently, to provide evidence of integrity. At present the study area represents an example of intensive viticultural landscape, but it safeguards important signs of past and traditional agricultural methods, that become strategic elements for the future development in terms of cultural heritage.

Wildland fires and fire use in Spain: a historical perspective

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Keywords: Central Mountain System, historical geography, Spain, wildland fire history, prone areas, culture.

Fire is a natural and cultural element that has been present in the territory since the beginnings. It has accompanied the development of civilizations and helped to shape the landscapes. Since prehistoric times, fire has served as a tool to human activities, but it has been at the same time a natural and human-induced risk.

Wildland fires, defined as those fires that spread without control over a woodland system, are a complex phenomenon that is related to climatic, botanical and social factors as well as to the physical and human characteristics of the territory. Accordingly, environmental and social changes influence fire regimes and the nature of forest fires. The manifestations of wildland fires are changing through space and time, in accordance with the evolution of the environmental conditions and the organization of socio-spatial systems.

The knowledge of wildland fire in Spain is limited, because the available information from the statistical data bases organized in 1968 covers a relatively short period. As a result, the interactions that have been established throughout time between environmental conditions, the social context and fire regimes, as well as the evolution of the spatial patterns of fire behavior, all of which reflect into the emergence of territories at risk, are not well known.

The objective of this paper is to present the first results of a research project which aims at documenting and analyzing the wildland fires regimes during the Holocene in the Central Mountain System (Spain). For this purpose, an interdisciplinary and multiescalar in spatial and temporal dimensions approach, that will allow us to reveal the evolution of fire regimes in this Spanish natural region and to characterize fire-prone areas through history. The working methods, coming from Historical Geography and Paleoecology, are based on historical analyses from the 12th century on, geographical analyses, biogeographic studies and palynological analyses.

The 7000-years-old Aleutian settlement and palaeoenvironment

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Keywords: shell middens, Aleutian Islands, dynamics of ecosystems, stable isotopes, zoogeography

Archaeological site ADK-171 is situated along the precipitous coast of the almost closed Clam Lagoon on Adak Island (Aleutian Islands). On the site shell midden was discovered. The excavated midden has clear stratigraphy with two discrete layers. Radiocarbon dates show that the cultural midden at ADK-171 was formed proximately 7000 years ago during a relatively short time period of about 100–200 years.

Analysis of faunal remains showed that settlers were marine hunter-gatherers and consumed marine invertebrates (sea urchins, cockles, mussels) and vertebrates (sea mammals, birds and fish). Remains of cold-loving species like Crenate Barnacle (*Balanus crenatus*) and Saffron Cod (*Eleginus gracilis*) allow us to assume that colder climate conditions were in this area 7000 years ago.

There is a difference in faunal composition and abundance of some invertebrates between lower and upper layers. Abundance of sea urchins and Nuttall's cockles increased, diameter of sea urchins testa became larger. At the same time changing in ratios of stable carbon isotopes in sea otters (*Enhydra lutris*) bone collagen indirectly shows changes in sea otters abundance in the Clam Lagoon. We hypothesize that such picture is a result of human activity during the settlement existence. Hunting on sea otters and decreasing of their abundance in almost closed lagoon removed predator's pressure on sea urchins and cockles populations and caused increasing in number of these invertebrates.

Session B

Beyond case studies in historical ecology – the search for general patterns of ecosystem change

Organizer: Martin Hermy, Katholieke Universiteit Leuven, Belgium

Keynote: Sara A.O. Cousins, Stockholm University, Sweden

Using landscape history to understand present ecological patterns and processes

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Keywords: biodiversity, conservation, extinction debt, fragmentation, landscape ecology, map, species richness

Time has always been acknowledged as explaining ecological patterns within biogeography, but it is only during the last couple of decades that landscape history has been used to explain current and future ecosystem change at local scales. Habitat loss and fragmentation of natural and semi-natural habitats is a major cause of biodiversity loss in the world, but declining populations often take considerable time to disappear, resulting in what is termed an extinction debt. Although evidence for extinction debts is incongruent, it has recently received great attention within conservation biology. Detection of extinction debt depends on both scale and specialisation and the time and magnitude of landscape change. Focussing on one particular scale, landscape type, ecosystem or organism may be the reason for finding an extinction debt or not. Few studies actually declare the extent of fragmentation within their system, and to predict future effects on species richness or populations we need good baseline knowledge of past landscape configuration.

New possibilities using modern techniques in geography with ecological theory have provided an excellent platform within historical landscape ecology. Yet one major drawback is the time-consuming task of collecting data at landscape scales and to be able to compare results from several different landscapes and ecosystems. We need even more case studies from various ecosystems and landscape types from different parts of the world. However, to be able to find general patterns on how past landscape history and land use change can explain ecological patterns and processes there is a need for a meta-analysis of the results. Furthermore, spatial historical data are often lacking, so we need to find proxies that can be used for modelling past landscape changes thus involving ecologists, historians, geographers and other disciplines.

Historical ecological studies have the possibility to take on one of the great challenges within conservation; to incorporate the dynamics of both time and space in broad scale ecology.

Predictability and change in Wisconsin (USA) plant communities since 1950

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Keywords: change, homogenization, fragmentation, predictability

Most studies of ecological change lack quantitative data or replication, limiting generalizations about ecosystem change. We are using 1950s baseline data from 342 spatially dispersed sites and five community types to estimate long-term shifts in Wisconsin plant community richness, heterogeneity and composition. We also use data on local site and surrounding landscape conditions and species functional traits to assess how predictable the observed changes are. Overall results reveal large shifts in species composition with declines in diversity and increased dominance by habitat generalists tolerant of shade. Local environmental factors have become less accurate predictors of species diversity and composition while landscape drivers and geographic distance have become more important. Across sites, habitat fragmentation and urbanization now provide predictions of species loss and homogenization, particularly in more fragmented southern regions. Across species, growth form, specific leaf area and total leaf nitrogen often predict which species are declining or increasing in abundance or range. Although most of these general trends occur across communities, they vary in extent and sometimes type by region or community type, complicating general predictions about ecosystem change. Changes at individual site are also difficult to predict, reflecting the importance of disturbance histories and landscape context. The utility of functional traits for predicting community changes depends on the particular plant community under study. Future comparative studies will benefit by increases in data on functional traits for more species and communities tracked over time. These results coupled with the intimate knowledge many managers and researchers have give us hope that we can further improve our ability to sustain diversity at landscape scales.

Comparative historical ecology of trans-atlantic mountain landscapes

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Keywords: Southern Appalachia, Atlantic Pyrenees, sustainable landscapes, comparative mountain systems

Historical ecology provides a critical bridge between the unique values of site-based research and the transdisciplinary collaborations necessary to planning and managing sustainable landscapes in practice. In this presentation we discuss our long-term comparative historical ecological research in the Southern Appalachian (USA) and North-facing Western Pyrenees (France) mountains centered respectively on the Little Tennessee and the Soule River valleys. Mountainous American and European landscapes have undergone significant changes during the second half of the 20th century including agricultural abandonment, reforestation, second-home development, faunal homogenization, and invasive species. While these processes are salient, they also represent examples of transformational events within the continuum of change that American and European landscapes have been undergoing for millennia. Our comparative historical ecological research in the Little Tennessee and Soule river valleys makes clear that no one factor can be said to “drive” the transformation of the landscapes of these two mountainous regions towards un-sustainability. Instead, there are various forces that both push and pull the systems along a use-intensity gradient that creates a shifting balance according to the relative influence of social, economic, cultural or environmental circumstances. Revealing how the relative influence of different factors shifts both across space as well as through time is central to overcoming the tragedy of simple solutions. Tragic because while adherents believe the solution is useful, the systems themselves continue their transformational trajectory toward states that are ever more difficult to recover from. Through our comparative, long-term historical ecological research in Southern Appalachia and the Western Pyrenees we are able to generalize understanding the forces of change that transcend the knowledge gained at individual sites.

The summit rush of plants and botanists

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Keywords: alpine flora, biodiversity, global climate change, historical data, long-term vegetation changes, tourism, 150 summits

Botanists have centuries ago climbed many high summits in the Alps to study and describe the frontiers of plant life in the nival zone. These researchers have collected a wealth of data on the vegetation on more than 350 summits and passes above 2600 m, thereby botanizing several sites repeatedly over time. This data is especially suited to study long-term vegetation changes, as summits and passes are easy to re-locate and as alpine areas, in contrast to other landscapes, are still reasonably pristine. Also, changes in climate and land-use such as pasturing, tourism or hunting of large herbivores have not occurred synchronously and homogeneously, which allows us to analyse their effects independently of each other with a large enough dataset.

For our study, we aim at revisiting and botanising 150 summits in the Swiss Alps between 2200 to 3500 m altitude. First analyses of a subset of these summits show that the species richness on mountain tops has increased by about 60% over the past 100 years, while around a fourth of the species that were present in earlier surveys disappeared. Factors characterizing direct human influence such as tourism clearly correlate with changes in species composition: Local colonisation events were reduced and extinction events increased on summits with high hiker densities. We will extend this new dataset in the coming summer with the goal to describe plant species diversity on alpine summits and identify drivers of vegetation change, thereby disentangling the roles of climate change, land-use and population size of herbivores and hikers.

2000 years of plant successions in an old Mediterranean grassland: will the Roman finger-print disappear one day?

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Keywords: historical ecology, land-use history, vegetation, past land use, succession, old-field succession.

Combined archaeological and ecological investigations in a large Mediterranean dry grassland in Southern France have revealed a dense network of ancient enclosures related to pastoral practices and dating from the Roman to the Modern periods. Here we show a strong correlation between present-day vegetation and soil characteristics with the spatial and temporal patterns of the location and exploitation of the Roman, ancient and modern enclosures. Plant composition and species-richness vary according to times linked to long-term changes of chemical soil properties after enclosures abandonment. Then, for the first time, we demonstrate the existence of a long-term plant succession of two millenniums in a herbaceous plant community, and that even small spatial variations of some former pastoral activities (sheep concentrations in small enclosures) in the Roman period may be irreversible at the plant community level during historical times scale.

Large scale impact of Roman agriculture revealed by LIDAR remote sensing in present day forests

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Keywords: land-use history, forest, remote sensing, lidar, Roman period, large scale mapping

One of the major challenges of historical ecology in highly anthropogenic landscapes is the search for ancient forest cores, if they exist, and, more generally, the understanding of long-term and broad-scale land-use change patterns.

However, until now, accurate tracking over large areas of land-use movements has been mainly conducted using ancient maps and historical documents, available for the Modern times only. It was most often assumed that, prior to this period, the so-called ancient forests had never been used for agriculture.

Lidar remote sensing can help break this time barrier. This breakthrough technology allows to “see” under forest canopies over large areas. Here we show why it has revolutionized the perception and mapping of ancientness in woodlands of France. After a brief technical overview of Lidar, we present the results of various campaigns we made in recent years. Huge and dense land parcel systems, some of which we could date from the Roman period, appear under the canopy. Large forest areas (> 10 000 ha), previously considered as ancient according to the threshold year 1600, were entirely cultivated in Roman times.

We studied the ecological legacies of these very ancient practices. They appeared almost as strong as those observed in more recent abandonments, from the XVIIIth or XIXth centuries. Plant and insect diversity, chemical characteristics and microbial communities of soils still keep the imprint of manuring and soil amendment practices, even nearly two thousand years after abandonment.

Our results show that agriculture has not only shifted by pulses around cores of human settlements, according to the vicissitudes of time, but has also experienced drastic changes in location. The studies of biodiversity patterns in forest ecosystems must take into account these early deforestation patterns. Lidar offers the possibility of mapping them over entire regions or even European forests as a whole.

Historical land-use as long-term forest dynamics driver in European Russia

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Keywords: forest history, traditional agricultural systems, slash-and-burn, tillage, vegetation succession, soil morphology, European Russia

We produced ecological history of unmanaged forests in case study areas located in various regions of European Russia (Karelia and Komi Republics, Vologda, Kostroma, Tver, Moscow, Kaluga, and Voronezh regions). Vegetation and soil sampling together with historical records were analyzed. Methods of soil morphology for historical reconstruction of ecosystem development were proposed. They were based on an idea that various human and natural impacts (fire, plowing, tree-fall, tree roots growing and dying, and others) have formed specific soil patterns. An inverse problem to reconstruct a list of impacts and their order along the soil morphological signs can be determined.

Our results showed that appreciable human induced changes in the studied regions caused mainly by the following agricultural activities: slash-and-burn cultivation (has started since 4000 years BP), plowing agriculture (has been extended since 1000 years BP), shifting agriculture (with plowing has started since 500 years BP). A total list of land management activities was the same for all areas and the main of them were the following: slash-and-burn, forest grazing, plowing, fires, timber cutting, and tree planting. But there was difference in the impacts beginning, duration, and alternation with free ecosystem development for different geographic regions. Results show there was nonlinear development over the all studied regions: forest recovery and forest degradation were not linear unidirectional processes as for a level of local ecosystems, as for a landscape level. Percentages of forest lands and plowed lands for regions increased and decreased in different time. Differences in the historical land-use practices for different geographic regions will be also discussed in the presentation.

The creation of species pools in cultural landscapes: natural community analogs, niche construction and niche shifts

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Keywords: conservation biology; human niche construction; realized and fundamental niches; semi-natural grasslands; species richness

Since the Neolithic, humans have had major impacts on the structure and distribution of forest and grassland communities in NW Europe. Generally, the cultural landscape created by opening of the vegetation by deforestation and grazing or mowing management was associated with the development of high species richness both locally and regionally. Over the last decades there has been a debate on the issue of “where” (geographically and ecologically) the species pools associated with the open cultural landscape came from, considering the dominance of forest thought to have prevailed before the Neolithic. The debate has mostly focused on two alternatives, both founded on the assumed existence of “natural” community analogs, being caused either by grazing/browsing by wild megaherbivores or by combinations of different disturbances (including herbivory) and locally unproductive habitats. These hypotheses do not incorporate mechanisms based on niche shifts in species habitat requirements. Niche shifts may result purely from changes in the positioning of realized niches within fundamental niche space, or from evolutionary changes in species niche requirements. If niche shifts are common, it may be that we misinterpret the ecological background of the species pools in cultural landscapes, and that a search for “natural” analogs to the open grassland communities of the cultural landscape is futile. I will discuss these different hypotheses and use an example from species pools in a cultural landscape in Sweden to show primarily that the present basis for discriminating between these hypotheses is very weak, and also make a few suggestions on how to examine them in more detail. An explicit consideration of niche relationships, both the human niche construction and the potential for niche shifts by species responding to human impact is likely needed in order to understand species performance in both the historical and present-day landscapes.

Posters Session B

Revisitation studies overestimate rates of local extinction

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Keywords: complete survey, connectivity, conservation, extinction rate, mountain plants, revisitation

Revisitation studies, which examine historical locations of species for present-day occurrence, have a long tradition in historical ecology and are an important tool in nature conservation, e.g., to assess local extinction rates. Revisitation studies take information from old literature, historical field surveys or herbarium and museum specimens. However, revisitation studies suffer from the inherent problem that only species decline can be detected. Researchers either assume that a decrease in the number of occupied sites is a general fact in rare species or they survey a sample of formerly un-occupied, but seemingly suitable habitat patches to determine whether species colonized new patches. It is however clear that only complete area surveys allow for an accurate estimation of local extinction rates. Here, we combined a classical revisitation study with a complete survey of 100 plant species in a mountainous area of 174 km² in the eastern Swiss Prealps. The distribution of these 100 species in the study area had been assessed in a complete and detailed survey at the beginning of the 20th century. Based on this unique historical information, we were able to determine differences in local extinction rates detected by revisitation studies and by complete surveys. Our revisitation study detected an average loss in occupied sites of 51%, while this decline was less severe in the complete survey with only 27% (difference significant at $P \leq 0.001$). At a higher spatial level than individual sites, the revisitation study found a decrease in occupied 1 km²-grids of 43%, while the decrease was only 31% in the complete survey ($P \leq 0.001$). At the regional level, considering patch connectivity (measured as largest patch index, LPI), the revisitation study resulted in a decline in connectivity of 39%, while the complete survey found a decline of 23% ($P \leq 0.001$). Our results clearly demonstrate that revisitation studies can dramatically overestimate local extinction rates and that the degree of overestimation diminishes with increasing level of data aggregation.

Reading ancient forest landscapes in the Belgian Campine region. An exercise in historical ecology

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Keywords: ancient forest, Campine region, landscape history, sandy soils, management history.

The interdisciplinary research project focuses on the ecological history of ancient forests in the so-called Campine region of the current Province of Antwerp, Belgium. This region is dominated by relatively poor sandy soils and the landscape consisted mainly out of heathlands and small-scale arable fields. Forests were very limited in number and extent. This until the 19th century when the heathlands were transformed in pine forests in the context of the new mining activities in Wallonia and Limburg.

The aim of the project is to examine the reciprocal relationships, during the ancien régime, between social and economic variables (property, power, market) on the one hand and forest landscape and biological characteristics on the other hand. These questions are applied to three rare examples of large ancient forest complexes (Zoerselbos, Grotenhout and Peerdsbos) in the Campine region. The three forests have been examined focusing on historical property relations and dynamics, their botanical composition, landscape features and past management activities and this in relation to the heuristic potential (historical sources, historical ecological values and relicts in the landscape).

In this presentation, a synthesis will be presented of the similarities and differences in the ecological history of these three ancient forests.

The lost traditional and cultural landscapes of Białowieża Primeval Forest

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Keywords: landscape history, traditional forest use, human impact

Recognition of the history of landscape plays the crucial role in understanding the contemporary dynamics of the forested areas. In the case of Białowieża Primeval Forest (BPF), located in Poland and Belarus, the historical and archaeological study revealed that landscapes of BPF before 1800 were influenced by a traditional, multifunctional use combined with centuries-long conservation of forest. The traditional utilisation encompassed royal hunts (BPF was a royal hunting ground in the 14th–18th centuries), non-timber utilisation on the basis of access rights (16th–18th centuries), and manufacturing forest products (late 17th–18th centuries). Accumulated in space and time, those uses led to creation of various semi-natural and cultural landscapes. Monarchical hunts contributed to the creation of “hunting gardens” – fenced parts of the forest including various forest habitats and a clearing with hunting bowers. Another traditional landscape resulted from the use of access areas (haymaking on forest meadows and traditional bee-keeping). In this case, anthropogenic impact was visible in: (a) enlarged area of regularly scythed meadows along river valleys, (b) creation of wooded meadows with single old trees in oak-lime-hornbeam forest habitat, and (c) “lado” forests – pure pine forests formed in coniferous and mixed coniferous habitats by frequent fires caused during bee-keeping and other activities. More heavily transformed, cultural landscape appeared in the second half of the 18th century; it included a few villages, located inside the forest, and charcoal and wood tar manufacturing places. Most of anthropogenic landscapes in BPF started to disappear after cessation of traditional management in the early 19th century (royal hunting gardens, manufacturing sites) and throughout the 20th century (abandoning of scything river-side meadows). However, some of the elements of human-transformed landscapes appeared very long-lasting (villages inside forest, roads) or assumed different functions (mowing some of meadows for conservation of European bison and other species).

Grazed woodlands, wood pastures and abandoned wood pastures in the Carpathian-basin from the 18th century until today

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Keywords: wood pasture, forest grazing, abandoned wood pasture, Carpathian-basin, Hungary, traditional ecological knowledge, nature conservation

The long-forgotten wood pastures providing habitats and grazing places during forest utilization became known again in Hungary in the last years mostly due to forest-related landscape history research. Our goal was to discover the interlocking, the coverage and the history woodlands and livestock husbandry, to analyze their effects on the vegetation, and to find future possibilities for the utilization of this kind of landscape.

We processed nearly 300 pieces of ethnographic, forestry and forest history related works, and we analysed the data of the Landscape Ecological Vegetation Database and Map of Hungary as well. Furthermore, we made case studies in wood pastures, where knowledge about landscape history and botany and traditional ecological knowledge were collected in the oak-hornbeam and beech woodland region in Hungary and in the oak-hornbeam-beech and spruce woodland region of Transylvania in Romania.

Forests were one of the fundamental bases of the versatile traditional grazing system in the whole Carpathian Basin. One of the most important factors leading to the decrease of grazing in forests in Hungary was the act on the separation of forests and pastures, which came into force in 1853. The abandonment of wood pastures and grazing forests started in the 1960s, but this process intensified in the last 20 years due to the massive decrease in the number of livestock. At the present time, wood pastures cover about 5500 hectares. Nature conservation activities and the revival of silvopastoral systems made in several areas of the country in the last 1–2 years proved that the data of historical ecology – collected about wood pasture and forest grazing – complemented by the traditional ecological knowledge are essential bases for such activities. This fact underpins the importance of these kinds of research aiming to develop a more sustainable landscape.

Bryofloristic changes in the last 100 years: On the use of herbarium data

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Keywords: bryophytes, herbarium data, distribution, altitudinal range, red list, conservation

Natural history collections in general and herbaria in particular contain unique information on the historic occurrences of organisms. Given the enormous collecting activities in former decades and centuries, these data provide access to time scales far longer than usual in ecological studies. In Switzerland, the collection of bryophytes has a long history, starting in the early 19th century. Swiss herbaria thus contain large amounts of recent and historical bryophyte specimens. In many cases, the labels of the herbarium specimens give quite detailed information on the collection date, the sampling locality and the altitude. We used here a unique set of thousands of historic and recent bryophyte data to show some applications of these kinds of data in ecology and species conservation. When using herbarium data, special attention has to be paid towards different sampling efforts in different time periods. To circumvent this problem, we applied different subsampling schemes to account for different sampling efforts. Moreover, we compared trends to reference distributions based on large numbers of herbarium specimens. In that way it was possible to reveal robust results despite different collecting efforts over time. So far we used these data to compare frequencies of bryophytes in historic and recent time periods and to compare altitudinal range changes of more than 60 species in the last 100 years. At the moment we scrutinize more applications with a special focus on trends of mean indicator values within regions based on herbarium specimens.

Combining National Forest Inventory databases and ancient land-use maps: a way to generalize case studies

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Keywords: Etat-Major map, national forest inventory, naturality index

French forest cover has doubled since the beginning of the 19th century, when it reached its minimum. It is now well established that former land-use has a significant effect on the composition of biotic communities in present day forests. However, most of the ancient forest studies have been conducted at a local level. Coupling the digitization of ancient land-use maps at the regional or national level with recently built, large, vegetation databases would allow a generalization of previous results at a broader scale and permit a landscape approach of forest cover change. The aim of the present study was to test this coupling at the level of the entire Lorraine region (NE France) by (i) establishing ancient/recent forest maps, (ii) identifying ancient and recent woodland species in National Forest Inventory vegetation database and (iii) comparing the obtained lists with already published ancient woodland species lists. French Etat-Major maps (1826–1837) covering the Lorraine region (23 500 km²) were scanned, vectorized and georeferenced. This first map was then intersected with the modern forest map (French National Forest Inventory) in order to build the ancient/recent forest map. Forest cover was 29.6% in the 1830s and 34.9% in 2000. Whereas only around 50% of French forests are supposed ancient, in Lorraine the majority of present day forests are ancient forests (76%). Moreover, recent forests are highly connected with ancient forest: 87% of recent patches are directly connected to, and 99% are located within 2000 m of, an ancient forest core.

In a second step, a join between the ancient/recent forest map and 7042 vegetation plots (National Forest Inventory) allowed us to identify ancient, recent and indifferent woodland species. 75 species were statistically more frequent in ancient forest and 81 species more frequent in recent forest. Thus, the use of NFI databases allowed the screening and identification of a large number of ancient woodland species, which is not usually possible in more local studies.

Do feudal mottes reveal ancient or recent patterns of plant species and seed bank composition?

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Keywords: historical ecology, land use history, seed bank, soil, vegetation

Ecosystems are historical: their current conditions are shaped by past events. Forests are well suited for investigating relationships between past land use and vegetation since they are expected to be weakly impacted by current human activities and to better preserve archaeological sites compared to other terrestrial ecosystems.

In this study, we focused on an artificial habitat type, which was created by man during the Middle Ages: the feudal motte, which is a giant mound of earth with very steep slopes.

Our primary goal was to determine whether such man-made artefacts could leave a long-lasting imprint in the vegetation once the forest has recovered. Our results revealed that feudal mottes were supporting plant communities that significantly differed from the surrounding vegetation, but species richness did not significantly differ. Calciphilous, light-demanding and eutrophic species were significantly more frequent and abundant on the archaeological sites, compared to control sites. Fifteen species were significantly more frequent on feudal mottes, whilst only 6 species preferentially occurred on the unoccupied sites. Some species were even restricted to one type of site: *Campanula trachelium* on feudal mottes and *Dryopteris carthusiana* on control sites.

Our secondary goal was to determine if the soil also bears the imprint of past land use, through chemical characteristics and species composition of the seed bank. We found significant differences in soil chemistry and soil seed bank composition between the two types of sites, suggesting long-lasting effects of artificial reliefs created by man. Some plants, known as herbals, edibles or ornamentals, like e.g. *Ribes nigrum*, *Verbascum thapsus*, were even only present in the seed bank.

Herb layer recovery in post-agricultural black alder woodlands of SW Poland

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Keywords: afforestation, *Alnus glutinosa*, forest history, ancient woodlands, woodland herbs migration, old maps

Ancient alder woodlands (alder-ash carrs and wet alderwoods) belong to the communities that maintain the greatest biodiversity among the European temperate woodlands, and many of their herbaceous species are indicators of long-continuity forests. In SW Poland (Żmigród Valley and Oleśnica Plain) they exist there in relatively dense forested landscape and are located within large forest complexes, where they occupy periodically waterlogged sites or places with a high level of groundwater. In many cases they coexist with black alder-dominated recent, post-agricultural woods, occupying the wettest and the most fertile sites, thus being very important elements in the spectrum of recent forests currently present in human-dominated landscapes. A spatial contact of ancient and recent alder woodlands provide a good opportunity to study the forest restoration process. The knowledge on the age and origin of forests which currently exist in the landscape is of crucial importance in studies on herb layer recovery in recent woods. The colonization of secondary alder forests by woodland herbs was studied and related with the research on edaphic and hydrological conditions. The migration process of woodland species proceeded here faster than in less fertile and drier sites. However, ancient woodland herbs exhibited a diverse colonization capacity. The migration rate of many of them was higher than reported in previous studies, whereas other species did not migrate at all. Maps illustrating the age and origin of forests appeared to be an invaluable tool in explaining differences in the distribution of forest herbs and soil conditions recorded in ancient and recent alder woods. Such maps allow the ancient forests which are potentially richest in biodiversity to be easily located. Old maps also provide information for further environmental studies, i. e. those focusing on the reconstruction of the history of the sites, and can be used in combination with the data from soil profiles.

Forests in France in the XVIIIth century. A quantitative and qualitative analysis from the so called Cassini's map

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Keywords: France, forest history, dynamics, GIS, ancient forests

In 1747, King Louis XVth missions Cassini IIIrd to undertake a «General map of France». The aim was at that time to finalise the measurement of the kingdom and to determine the number and position of villages, towns, rivers, and main paths. In less than 40 years, 96% of current France, but also 1.8 million ha on its frontiers, have been mapped. The forests are mapped with different drawings. Regularly used by foresters to give an idea of the history of an ecoregion, this map has not been yet analysed globally using GIS. The current study seeks to fill that gap, especially with the aim to explore and specify its strengths and limits for various possible uses (identification of ancient forests, landscape dynamics studies, implication of ancientness on biodiversity, dynamics, fertility...). Using the 181 sheets of the geolocalised so called Cassini's map, the present work has digitised all the forest contours, whatever the area. Beyond solving numerous methodological problems (geographical conversion, interpretation, error) which are discussed, the 49251 forest polygons give us a synthetic vision of the forests in France during the second half of the XVIIIth century. Of the 54.5 million ha covered by the map, 7.1 million ha are woods, i.e. forest cover is 13%. On the current French territory covered by the map (52.7 million ha), only 6.6 million ha are forests, i.e. forest cover is 12%. These figures are compared and discussed with other estimations undertaken in France in the past. Forest varies a lot spatially: Ardennes, Lorraine, Alsace, Franche-Comté, Bourgogne, but also Var for example, are the most forested regions at that time (>25%). Compared to current situation (Corine), a preliminary exploration of the quantitative, qualitative and spatial trends of the forests is presented for 21 administrative regions of France, but also for key large forest regions chosen to be representative of forest history, and at last, after specific treatment, for several small areas (departments, Var, Hautes-Alpes, Pyrénées-orientales). At this scale, several descriptive variables are analysed in light of forest history (forest types, property status, protection status, ecological interest). The results enable to better define some first lessons learnt and the possible utilisation of that spatial information on forest history. This study, providing GIS layers of forest history on large scale – and free of copyright –, is only at its beginning. It opens many possibilities of analysis on ancientness of forest in France, and is rich of scientific (history, natural sciences) and management perspectives.

Can motor vehicles substitute the movement of livestock for effective seed dispersal in the modern rural landscape?

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Keywords: anthropolochory, conservation, endozoochory, functional connectivity, grassland

Before agricultural industrialisation, the dispersal of plant species through the rural landscape was largely mediated by the movement of livestock. Today, species-rich, semi-natural grasslands exist as only small, isolated fragments, and livestock are generally kept within the same pasture throughout the grazing season. On the other hand, the introduction of motor vehicles has provided a potential vector for seed dispersal through the landscape, and farming machinery, which is not confined to roads, can pick up and deposit a great deal of material. Our aim was to explore the potential for motor vehicles to maintain the functional connectivity of the landscape in the absence of free-ranging livestock. We collected manure samples from grazers on semi-natural grassland pastures, and mud from the cars and tractors of five farms during the outdoor grazing season in a 10 km² landscape in southern Sweden, and grew them in a greenhouse to assess their seed content. 31 713 seedlings of 109 species emerged from 31 manure samples, while 12 675 seedlings of 111 species emerged from 49 samples of mud removed from motor vehicles. Both sets of samples were dominated by the genera *Agrostis* and *Poa*, which together stood for 43% and 77% of the seedlings emerging from motor vehicle and manure samples respectively. Otherwise, manure samples contained several grassland specialists, whereas, despite the occasional grassland species, widespread ruderal species made up the majority of the rest of the seeds dispersed by motor vehicles. Our results indicate that motor vehicles do not provide an effective link for the dispersal of grassland species through the rural landscape, and that the movement of grazers between fragmented grasslands should be encouraged to improve functional connectivity and biodiversity in the rural landscape.

Spatio-temporal changes and loss of ecosystem services: the role of history to São Sebastião Island – Brazil

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Keywords: ecosystem services, spatio-temporal change, landscape history, timeline, São Sebastião Island

The landscape structure is the result of human pressure and land use/land cover changes along the time. As a consequence, important ecosystem services begin to decrease, in rates that depend on the intensity and kind of actions over the territory. Therefore, it should be possible to evaluate the ecosystem services availability along the time, if the history of landscape changes is known. The goal of this paper is to show these relations in a study case (São Sebastião Island – São Paulo – Brazil), through the identification of five centuries of history; time line construction; elaboration of correlation graphs between ecosystem services and landscape changes; and measurements of services offer. The results indicate that services availability is highly related to prevalent structure along the history. Thus, for example, 70% increase of urbanized area in a watershed over the last 40 years, decrease 2.8% in food production service. However, 23% increase of forest in the same watershed increase 54% in nutrient cycling service. The data are important because give support to decision makers, mainly in this Island, that has a great diversity of the social agents, from big enterprises to traditional people.

Scaling from local to regional analysis: forests and farms in the Chesapeake Bay Basin

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Keywords: historical GIS, scaling, forests, agriculture, Chesapeake Bay, USA

Scale is an important consideration in any environmental study and many studies focus on a particular spatial, temporal, and nominal (categorical) scale. Bridging between different spatial, temporal, and nominal scales can facilitate the re-examination of conclusions drawn at a particular scale, and offers the potential to find and analyze more general patterns of change. A historical GIS approach was used to examine changes in forests and farm land in a portion of the Shenandoah Valley of Virginia from 1850 to 2000. Features extracted from historic maps were analyzed and then compared to agricultural census information on the amount of land in farms. The agricultural census was collected nationally at the local county level from 1840 to the present in the United States. The local study found different spatial and temporal patterns than what had previously been inferred from larger area studies. One factor influencing this divergent pattern is the categorical information being used in other studies. The refined understanding of changes at the local scale were then used to re-examine changes to forests and farmland over the same period of time in the State of Virginia and the Chesapeake Bay Basin based on currently available digital information.

Strategies of plants in fragmented grasslands: to endure or escape?

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Keywords: extinction debt, calcareous grassland, habitat loss, dispersal, persistence, species extinctions

Loss of area and concurrent fragmentation of many species rich habitats can result in local extinctions of characteristic species. However, possible occurrence of extinction debt makes it difficult to predict the effects of area and quality loss, thus it is important to determine which species are most vulnerable to future extinctions. By using the unique set with historical (1923) and current (2008–2009) species composition data from the highly fragmented landscape, where extinction debt is already paid, we directly track the extinctions of habitat specialist species. We identify the life-history trait values that characterize the species most likely to go extinct in the fragmented habitats.

Studied semi-natural calcareous grasslands have lost 90% of their area and 30% of their original characteristic plant species during the last 85 years. Taking into account phylogenetical relationships, locally extinct species were characterized by lower potential height growth, lower total seed mass and seed number per shoot, lower terminal velocity of seeds and lower soil nitrogen content preference compared to persistent species. Different dispersal and persistence ability of locally extinct and persistent species indicate that both increased habitat isolation and decreased habitat quality are important in determining the local extinctions of species. As highly fragmented landscapes often lack their metacommunity structure and functions, species strategies for long-distance dispersal are unfavoured.

We showed that in the community where extinction debt has already been paid, the extinct species have life-history trait values that differ from those of persistent species. Our results can be applied to less degraded grasslands, where the extinction debt is not yet paid, to estimate which species are most vulnerable to future extinctions.

Session C

Historical ecology and ecosystem modeling

Organizers: Harald Bugmann, ETH Zurich, Switzerland / Urs Gimmi, WSL, Switzerland

Keynote: Peter H. Verburg, VU University Amsterdam, The Netherlands

Historical land use and ecological modeling: from land use reconstructions to ecosystem dynamics

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Keywords: historical land use, dynamic modelling, reconstructions, carbon stocks, land use models

This keynote will provide examples of the role of historical land use data in planning and management of ecosystems across different scales. Model-based reconstructions of global scale land use are made to better understand the changing role of human influence on ecosystems and the functioning of the earth system. Based on such reconstructions the changing spatial patterns of human influence and interaction with the earth system can be better understood which helps the calibration of climate models and assessments of changes in ecosystem service provision.

At a national scale an example of the use of historical land use data to improve current-day inventories of carbon stocks and emissions is provided. Spatial patterns of soil carbon reflect historic land use over a period up to 100 years, therefore, accounting for historic land use is important.

Finally, it will be shown that reconstructions of historic land use play an important role in understanding future dynamics of land use and planning of environmental management.

Modelling earlier forest landscapes by combining forest inventory data with historical maps and other geographic information

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Keywords: forest

Data from the National Forest Inventories (NFIs), collected in the Nordic countries since the 1910s, provide an excellent source for studies in historical forest ecology. An important strength is that the NFIs provide information based on statistical sampling of entire countries and, that estimates and their precision can be provided for any sufficiently large sub-national region. During the early forest inventories data was collected along continuous transects, which as a side effect provide possibilities for spatial analysis at stand level. We use data from the first Swedish NFI from the 1920s to develop a statistically probable spatial model of the historical landscape. In brief we combine historical transect forest data with information from historical maps and other historical and modern geographic datasets. Data on the spatial forest composition, stand structure and stand size distribution is estimated from systematically inventoried 10 meter wide transects. We use information from the 1920 county economic map to delineate forest areas from other land-use categories, and to divide the forest area into coniferous or deciduous forest. By combining different historical datasets with modern data on physical landscape attributes we model the spatial composition for the forest area between the 10 meter wide transects. Digital elevation data, hydrological data, geological surveys, the current forest composition and other available digital geographic data sets provide help variables that increase the geographical realism of the model. By using transect data, we can estimate the stand size distribution and proportions of different forest types, even of the locations of the stands might be arbitrary. Our method could be a cost efficient way to develop historical forest information for larger areas. The results can be used by other researchers for landscape modelling and for strategic and detailed nature conservation planning.

Forest cover changes in the Polish Carpathians in the last 150 years

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Keywords: past forest cover change, forest transition, historical maps, statistical data, spatial models

Over the past decades forest areas in Europe have expanded significantly. Forest increase occurred mostly in areas marginal for agriculture like mountains and corresponded with land abandonment. Good examples of these processes are the Carpathians. Knowledge on the long-term spatial dynamics of regional forest cover changes is important as these changes have strong impacts on landscape and ecosystem services (e.g. biodiversity and carbon dynamics). The aim of our paper is to identify and model trends in forest cover change and its causes over 150 years for the Polish Carpathians.

As source of information about the forest cover we used statistical data at the level of village councils (*sołectwa*) and counties (*powiaty*), respectively from 1870, 1900, 1930s and the 1950s; these data were joined to administrative units received from historical maps. Next, satellite forest maps obtained from Landsat TM and ETM data (object-based SVM classification; 1980s and early 21st century) were used. To explain forest cover change we considered different variables (natural and socio-economic): elevation, slope degree and slope aspect (source: SRTM DEM), ownership (statistical and state forest data), population density, access to road and railway networks. Spatially models were constructed on a basis of data integrated and processed using geographic information systems.

We observed slow forest transition over the last 150 years in the Polish Carpathians. The forest cover had stabilised here by the 19th century, followed by a slow increase in forests, especial after World War II (caused by economic and social transformations leading to the decline of mountain agriculture). Since 1989, increase of land cover and land use change has been observed due to the complex transformations of former communist countries and the recent impact of EU accession.

Land use history and environmental gradients as driving factors of subalpine *Larix decidua* forests: a watershed-scale analysis.

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Keywords: stand structure, landscape structure, *Larix decidua*, cultural landscape, SEMs, Italian Alps

European larch (*Larix decidua* Mill.) forests in the Alps have been shaped by humans for centuries through traditional practices. A better understanding of the environmental and anthropogenic influences on these cultural landscapes is needed to predict their future trajectories. Landscape and stand scale dynamics were analyzed in 4 watersheds (c. 13 000 ha) of western (Val d'Ossola, VB) and central (Valtellina, SO) Italian Alps experiencing different past land use intensities. Biological and historical data sources were employed and a multi-scale approach was adopted to capture the influence of factors affecting the structure of this forests. Stand structure and a range of environmental variables were sampled in 205 circular (12 m radius) plots, and land use and anthropogenic variables were derived from thematic maps and aerial photographs. We used multivariate statistical analyses (ordination and SEM models) to relate forest structure, anthropogenic influences, land uses, and topography. The main observed land cover transition was an expansion of forests at the expense of wood pastures and open areas. All the studied watersheds (Musella, Ventina, Veglia, and Devero) were dominated by larch forests, but their structure and spatial pattern differed greatly. Anthropogenic variables were less important at Ventina, but emerged as fundamental to explain stand structure in all the other study sites. Complexity of topography and proximity to roads had largely influenced past human activities mainly at Musella and Devero. This study revealed the critical role played by forest harvesting and cattle grazing in shaping present Italian subalpine forests both at stand and landscape scale.

Modeling effects of historic forest litter raking on forest soil carbon pools

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Keywords: forest litter raking, forest soil carbon, land-use legacy, process modeling, biogeochemistry

During the past centuries, traditional use of forests included the removal of leaves and needles from the forest floor in order to use the litter for bedding purposes or as a substitute for straw to bind cattle manure. The long-term, repeated removal of forest litter led to widespread depletion of forest soils and is considered to have reduced soil organic carbon (SOC) pools and nutrient status. The magnitude of soil carbon depletion depends on the intensity, frequency and duration of these litter harvest practices and the state of recovery of the affected forest soils varies with the time since the practices were abandoned. Our study aims to quantify the effect of traditional litter removal on carbon pools in forest soils by combining detailed historical information on traditional forest litter raking in Swiss forests with process-based ecological modeling techniques using a coupled biogeography-biogeochemistry model, LPJ-GUESS with an improved soil carbon module (Yasso). We simulated effects of forest litter removal by applying a range of historic removal scenarios for four study sites representing a gradient of productivity across Swiss forests.

Our results show a significant reduction in forest soil carbon pools after long-term litter removal. Maximum soil carbon reduction ranges between 13% on less productive sites and up to 21% on sites with higher productivity under the most intense removal scenarios (i.e., annual harvesting). Reduction of SOC pools is sensitive to various aspects of the disturbance regime such as intensity (100% removal of the annual litterfall vs. partial removal) and return interval (annual removal vs. 5 year rotation). Our results suggest that contemporary forest soil carbon pools are still significantly reduced (by 5–6%), even after 100 years of recovery, after the abandonment of forest litter raking. Considering the widespread implementation of this historic land use practice, SOC pools in today's Swiss forest soils reflect legacy effects from past litter removal. The potential for future accumulation is estimated up to 4.5 tC ha⁻¹ for forests historically heavily affected by forest litter removal. Where intensive field data are unavailable (as in the case of soil carbon), the combination of historical knowledge on land use practices with mechanistic forest models provides a useful insight into long-term forest dynamics.

Separating human and climatic impacts on Mediterranean forests during the Holocene with paleoecology and dynamic modeling

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Keywords: paleoecology, landscape model, Mediterranean, broadleaved evergreen vegetation, pollen analysis, human impacts, climate change

Forests near the Mediterranean coast have been shaped for millennia by intense human disturbance. Consequently, it is difficult to distinguish the effects of past climatic change on vegetation dynamics from human impacts, or to determine natural potential vegetation under current or anticipated future climatic conditions. We combined the LandClim dynamic vegetation model with decadal-resolved pollen records to explore relationships among climate, vegetation, and human impacts near two coastal Italian lakes. Dynamic modeling allows us to isolate human and climatic impacts, and paleovegetation reconstructions provide empirical validation. Lago di Massaciucoli in coastal Tuscany, and Gorgo Basso in southwestern Sicily, experience mild, moist winters and hot, dry summers, but Gorgo Basso is warmer and drier in all months. At Lago di Massaciucoli, a forest of evergreen and deciduous oaks mixed with silver fir (*Abies alba*) was simulated. This unusual community with no extant analogue is remarkably consistent with pollen data predating extensive human disturbance before 6000 cal yr BP. At Gorgo Basso, simulated forests of evergreen oak and olive (*Olea europea*) cover most of the landscape. No similar community remains, but model output corroborates palynological evidence for olive-evergreen oak woodlands in Sicily before 2700 cal yr BP. Our results demonstrate the importance of paleo-environmental data – that predate observations and historical data – for model evaluation. Agreement between modeled and reconstructed vegetation implies that human disturbance not climate maintains the highly-flammable ecosystems typical of the Mediterranean coast. Our comparison of sites in northern and southern Italy demonstrates that promoting low-flammability, native, evergreen forests is a valid long-term management strategy for the current climate and for a warmer, drier future.

Modelling soil carbon dynamics under historical land-use in European Russia

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Keywords: agricultural systems, forest management, slash-and-burn, EFIMOD, ROMUL

We assessed the effects of different historical land-use and forest management systems on soil carbon dynamics using the model of carbon and nitrogen cycling in forest ecosystems EFIMOD linked with the model of soil organic matter (SOM) dynamics ROMUL. Forest stands on the sandy and loamy soddy-podzolic soils (Spodosols and Alfisols) located in the Central European Russia have been taken for the case study. The following agricultural and forest management scenarios were simulated: (a) slash-and-burn system (SB) with 3 years for crops and 20, 40, 60, 80 and 120 years for forest; (b) three-field crop rotation system (TF) with organic fertilization (dung) every 3, 9 and 18 years and the same rotation without fertilization; (c) short-term field-forest shifting system (ShS) with 10 and 20 years for crops and 10 and 20 years for forest; (d) clear cutting forest management system with rotation of 10 and 20 years for firewood forest (CC-FF) and rotation of 40, 60, 80, and 120 years for timber forest (CC-TF); and (e) selective cutting forest management system (SC) with cutting every 30 years and the intensity 30% of the basal area. Free forest development (Nat) without any management was also simulated as a reference scenario. Results showed that soil carbon decreased in the line: (1) Nat; (2) CC-TF; (3) CC-FF, SC, and TF with fertilization each 3 years; (4) SB with 40, 60, 80 and 120 years for forest, TF with fertilization every 9 and 18 years; (5) SB with 20 years for forest; and (6) all ShS scenarios and TF without fertilization. Preliminary results showed that global carbon cycle before the industrial age could be significantly changed by the medieval agricultural anthropogenic impacts. It is important to take into consideration under the global models' parameters evaluation.

Posters Session C

Bioeconomics and ecosystem services: how ecology can economically guide the economy

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Keywords: bioeconomic models, ecosystem services, ecological economics, economic growth, biophysical values

The major challenge when getting economic development and ecology together is how to bring sustainability into growth models. In this regard, bioeconomic models can provide a useful rationale upon which economic growth could be based. Although these models (forestry and fishery) are typically output-driven, a few adjustments could turn them more input-heeded. According to an ecosystem-based and ecological economic approach, the services rendered by whatever stock are the utmost objective of any economic activity. Therefore the inputs supplied by the sources of natural resources and the carrying capacity offered by environmental sinks should rule over the economic income arising from the output growth of money-valued stocks. Once both the provision of natural resource stocks and the absorption of the wastes arising from their economic processing strongly depend upon ecosystem services, a model is needed which is concerned with the reservoir providing these services rather than with the stocks living upon them. Such a model is put forward next in which carbon emissions from economic growth into the atmospheric pool are set a ceiling, just like the one met by the biological growth of trees standing in a forest and removing them. Not only does this care about the carrying capacity (environmental service) of the pool (atmosphere), but also offers economic growth some biophysical grounding (forestland). Provided emissions growth must meet an upper boundary, a bioeconomic supply function is given by the amount of emissions avoided and by the savings of biocapacity yielded accordingly. On the other hand, a bioeconomic demand function is set by the emissions arising from economic growth and by the sinking capacity needed to remove them. Thus, biophysical (e.g., in tones of carbon equivalent) rather than monetary prices can be estimated, thereby bringing ecological values back to the foreground and showing how weakly real wealth has been historically caught by money metrics.

Forest continuity estimated from historical maps

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Keywords: forest continuity, GIS, historical maps, land-use history, remote sensing analysis

Despite the lack of detail, historical maps can serve as a powerful tool in spatial analysis, due to the large temporal and spatial extent of this source. In our study a wide range of old topographic maps and estate plans from Zemgale region (total area 517 815 hectares) of Latvia for the period from 1770s to 2010 were digitized and rectified using a geographic information system (GIS). Based on these maps, a set of forest cover vector maps (1770s, 1820s, 1920s and 2010) was generated. To investigate land-use changes and forest continuity, the vector maps were divided in 25 ha squared patches. The percentage of forest area in each square was calculated. This method allowed to study forest continuity using maps of different scale, and to estimate the accuracy of the land-use data. Further, this crude scale was complemented by detailed studies on a finer scale for five forest clusters using data of estate plans, forestry inventory data in 1920s and field observations. The results of this study indicate that forests have various land-use histories since the mid-18th century, and the degree of forest continuity is minor. These findings are expected to increase understanding forest heterogeneity and succession depending on the past history of land-use.

Reconstructing the dynamics of past forested landscapes using long term 3D remote sensing methods

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Keywords: forest, tree, growth, time-series, remote sensing

The analysis of human influences on forest ecosystems could be greatly enhanced if long time-series of ecological observations and measurements were more widespread. The scarcity of such time-series can however be partly overcome by exploiting the large amounts of data that can be recovered from historical aerial photographs. Systematic airborne surveys started in the 1920s in Europe and North America. Since 1945, the photogrammetric quality of aerial photographs is sufficient for accurate 3D measurements using stereo techniques. This allows the retrospective quantitative analysis of forest dynamics over a period of nearly seven decades (1945 to present). For example, the effect of small-scale human induced disturbances, such as partial or clear cuts, regional transformations like afforestation due to farmland abandonment, or long-term global trends, such as growth rate increase due to CO₂ fertilization, or climate induced tree line advance caused by global warming, can be explored. We have recently developed methods for accurately measuring forest tree and canopy heights using historical photographs, thus overcoming two important difficulties: the occlusion of ground by dense canopies which precludes the measurement of heights, and automation of the height measurements. Our approach consists of precisely registering stereo-models of digitized historical aerial photographs to a high-resolution digital terrain model produced by a recent airborne scanning lidar. Using such combined datasets, an interpreter can directly measure the height of individual trees in the past, without the need to see the ground. What is more, by using computer stereo-matching techniques, time series of forest height maps over large territories can be generated with metric resolution. We present results for Canadian sites where we have reconstructed growth since the 1940s in 5 time steps. We show how this approach can greatly help linking historic changes in forest growth to human activities.

Methodological challenges for assessing two centuries of forest landscape changes in France

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Keywords: historical mapping, land cover changes, geo-spatial monitoring, forest patterns, photo-interpretation

French forests areas largely increased over the two last centuries. In this meaning, the knowledge of forest stand changes represents an important challenge for shaping future forest management policies. Given the relationship between the space and time scales appropriate for observing different aspects of patterns and processes, the understanding of forest dynamics can only be perceived on a scale of tens to hundreds of years. In this meaning, ancient map and modern imagery represent important basic materials to reach this goal.

The main objective of this research is to attempt assessing the trends of evolutions of two contrasting French forested sites on a long time series (150 years). These two sites respectively located in the plains (Orléans Val-de-Loire) and in the Mountain range of the French Alps (Vercors Regional Natural Park) have contrasting physical drivers but also different management history. The comparison of respective trends in forest changes among the two sites (velocity, ways and localisation) offers more general understanding of effects of past forest managements and may improve the definition of future management scenarios in regards of biodiversity versus production trade-offs.

In order to capture changes of landscapes' "essential characteristics", we use Ordnance Survey map of France (1840) in tandem with recent aerial images (1956/2000's). An interpretation of ancient map allows extracting roughly old-forest patterns. Conversely, the delineation of contemporary forest patterns is made accurately by the photo-interpretation of high-resolution aerial imagery. It results a hierarchical approach that looks at binary forest-non forest evolutions between 1840, 1956 and 2010. In addition to the assessment of these required long-term changes, this research finally focuses on the methodological challenges regarding important differences of semantic and spatial precisions between ancient map (handmade and hard-copy) and recent high resolution imagery.

Session D

Problems and possibilities on the border between historical ecology and environmental history/archaeology

Organizer and Chair: Lars Östlund, SLU Umeå, Sweden

Keynote: Nancy Langston, University of Wisconsin-Madison, USA

More than chronology: What can environmental historians offer on the frontiers of historical ecology?

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Ecologists are often eager to partner with environmental historians because they hope that historians can help them reconstruct the chronology of human events within a landscape. Important as these reconstructions may be, chronology is not history. Historians can offer students of landscape change something much more important than chronology: a fuller understanding of the causes and consequences of landscape change. Changes in the land are never just ecological changes: people make the decisions that led to ecological changes, and they make those decisions for a complex set of motives. When historians and ecologists operate in isolation, they run the risks of generating convincing but incorrect arguments about why changes happen. Using case studies from the Canadian and United States shores of Lake Superior, this talk will explore the ways that integrating social and ecological histories can lead to richer understandings of landscape change.

The pleasure of kin: convergent lineages in historical ecology

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Keywords: historical ecology, disciplinary origins, transdisciplinary practice

The separate origins and purposes of historical ecology have begun to flow together: North American and European, biophysical sciences and social sciences, theoretical and applied. Although historical ecology has diverse roots, its development has proceeded along two distinct pathways, with little dialogue between them. One lineage is concentrated in the social sciences, particularly anthropology/archeology and historical geography, while the other is embedded in the biophysical sciences, particularly paleoecology and ecology. What advantages these multiple strands bring to the necessarily transdisciplinary study of the co-evolved human/Earth system? We argue that it is important to recognize their independent origins because they bring valuable methods and insights, shaped by each discipline's critical scholarly practice. As the strands come together, they highlight areas where additional interdisciplinary work needs to be done (such as how to connect quantitative and qualitative data) and where related fields need to be joined (such as political ecology and restoration ecology). Ultimately, the term historical ecology will be of fleeting importance, as shared understandings reach into additional knowledge communities: e.g., philosophy, law, medicine. But first we must be comfortable with all the tools and approaches in the conceptual toolbox of an inclusive historical ecology; then a more encompassing term for the next stage of understanding will emerge, challenging practitioners anew.

The pre-1800 dilemma: How to deal with early written sources in historical ecology

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Keywords: written sources, pre-1800 dilemma, long-term studies, Europe, research methodology

Many historical ecological investigations are based on written sources. However, with few exceptions, such studies do not cover more than the past ca. 200 years. Because most of the world's landscapes have been under heavy human influence for much longer than two centuries, it is clear that historical ecology would greatly benefit from the broadening of its time-scope. This paper focuses on the utilisation of pre-1800 AD written sources in a European context.

Three main topics are discussed:

1. To establish why early sources (and therefore periods) are neglected, the paper analyzes the main differences between pre- and post-1800 AD sources in Europe. It is argued that for the last two centuries written data are numerous, easily accessible, precisely located in space and time, and compatible with the freshly collected information of ecologists. By contrast, pre-1800 sources are less accessible, usually occur outside a “statistical” context, tend to be imprecisely located in space, and are difficult to interpret. As a consequence, their use is limited at present.
2. Despite the above difficulties, the paper aims to demonstrate that pre-1800 sources can be successfully integrated into historical ecology. Several examples (from medieval Spanish account books to Czech urbaria and Hungarian perambulations) are used as illustrations.
3. Finally, the paper proposes a research strategy for the integration of pre-1800 written sources into historical ecological investigations. The two key aspects identified are the methods of collecting large quantities of data (which typically must be pieced together from many individual cases) and the transformation of data into a form that can be used alongside modern data.

Legacies of pre-Colombus activities in the landscapes and biodiversity patterns of French Guyana

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Keywords: land-use history, humid tropical forest, pristine forest, Amazon, dark earth, biodiversity

The influence of pre-Colombus populations on the Amazonian ecosystems and, consequently, their degree of naturalness, are actively discussed. We developed a research project (COUAC) in order to study the after effects of native population activities on present soil properties and ligneous vegetation diversity in forest ecosystems of French Guyana.

Neither vegetation nor ancient land use can be easily assessed in tropical forests. Thus, two complementary approaches have been used:

- At reference forest sites where complete tree species inventories had been previously established, we searched for archaeological evidences of former occupations, and analysed spatial relations between vegetation diversity and former occupations.
- At forest sites where archaeologists had demonstrated important occupations, we investigated soil physical, chemical, and microbiological properties and vegetation diversity in reference to adjacent undisturbed sites.

In contradiction to the long-standing view of the pristine forest of Guyana, we found a high density of indices of former land use, either as ceramic fragments, or as dark earths, or as large soil surface reworkings. ¹⁴C analysis of charcoal fragments embedded in ditches suggested that these occupations were initiated in 1355–1225 AD and lasted for several centuries.

Remains were most often found on hill summits, away from the major rivers. Terra mulata-type soils were frequently observed, marked by a deeper incorporation of organic matter (40–60 cm) than in reference soils, and sometimes higher d¹⁵N and available P. The stability of d¹³C in soils demonstrated no former long term cultivation of C4 plants.

At several large settlement sites, we measured an abnormally high tree diversity, and a high density of palm trees. The relation between measured diversity patterns and man-induced soil or forest changes is discussed.

A (pre)historic ecology of a high altitude alpine landscape: The Bronze Age to Roman Period in the Southern French Alps

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Keywords: French Alps, Bronze Age; Roman Period, landscape, environmental change

Archaeologists often reduce cultures to characterisations founded on assessments of material culture, settlement, and ritual structures. These categorisations can result in the homogenisation of interpretations of past societies. Palaeoenvironmental evidence is usually treated as a subsidiary data category; employed in the assessment of food production systems, and human impact upon, or exploitation of, the so-called “natural world”. Evidence for climate change is also presented as an influence on economic productivity, or choice of settlement location, rather than an active cultural agent in the construction of the day-to-day lifeways of people. Since 1998, integrated landscape archaeological and palaeoecological research in areas above 2000m in the Southern French Alps has studied a series of sites spanning the entire Holocene. The analysis of the waxing and waning of human activity in this high altitude zone adopts a historical ecological perspective, where emphasis is placed on investigating the relationships between peoples and environmental change; assessing the nature of landscape modification, climate change, and variations in both cultural and ecological resilience. Specific examples of sites dating to the Bronze Age and Roman period will be used to explore the intersection of environmental and cultural processes that operate at different temporal and spatial scales; from the long-term trends of climate and vegetation change, and their influence on broad scale landscape characteristics, through to the specific local processes that are investigated through the assessment of human activities as they relate to responses to possible changes in weather patterns in the high altitude zone.

New insights into the ancient woodland paradigm

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Keywords: ancient woodland, wooded landscapes, primeval savannah

The 2007 publication of the *Woodland Heritage Manual* (ROTHERHAM *et al.*, 2007) provided for the first time, a coherent guidance and approach to the assessment of ancient wooded landscapes. The methodology marries field ecology, archaeology, pedology, cartographic analysis, and historical and archival research. Since the publication, and in parallel to the woodland heritage project, we have been developing a critical analysis of the application of woodland botanical indicators, and a re-assessment of the placement of 'ancient woods' within an historical timeline in England. This sits alongside research into the historical ecology of medieval deer parks and their relationships to the great European savannah as proposed by Frans Vera (ROTHERHAM 2007a, 2007b; VERA 2000). The approach is based largely on work in the UK but it is being tested and applied in other European countries too. Research on indicators has been undertaken with the Woodland Trust and the British Ecological Society to inform and to test the designation of ancient woodland status in the UK planning control process. Together with fresh insights into historical factors (ROTHERHAM and WRIGHT 2008), these methodological approaches help bring a coherence to the study of wooded landscapes and their historical ecology. In particular, the work begins to place the medieval ancient wood into a wider context of the wooded landscape, and beyond this, into the landscape of Vera's claimed primeval savannah.

References

- ROTHERHAM, I.D., 2007a: The Historical Ecology of Medieval Deer Parks and the Implications for Conservation. In: LIDDIARD, R. (Ed.) *The Medieval Deer Park: New Perspectives*, Windgather Press, Macclesfield, 79–96.
- ROTHERHAM, I.D. (Ed.) 2007b: *The History, Ecology and Archaeology of Medieval Parks and Parklands*. Wildtrack Publishing, Sheffield.
- ROTHERHAM, I.D.; WRIGHT, B., 2008: Searching for the Ghosts: how a forester reads the woodland landscape. *World of Trees*, 16, 40–41.
- ROTHERHAM, I.D., 2007: The implications of perceptions and cultural knowledge loss for the management of wooded landscapes: a UK case-study. *Forest Ecology and Management*, 249, 100–115.
- ROTHERHAM, I.D.; JONES, M.; SMITH, L.; HANDLEY, C. (Eds.) 2008: *The Woodland Heritage Manual: A Guide to Investigating Wooded Landscapes*. Wildtrack Publishing, Sheffield.
- VERA, F., 2000: *Grazing Ecology and Forest History*, CABI Publishing, Oxon, UK.

New insights from comparing 18th century and current vegetation patterns

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Keywords: biodiversity, calcareous marsh, land surveys, preColumbian North America, settlement patterns, Virginia, wetlands

Since the beginning of sustained European colonization in eastern North America in the 17th c., people have radically transformed the indigenous vegetation through logging, agriculture, land development, altered fire frequencies and introduced species. In addition, the land cover itself has affected the patterns of these activities and the values people placed on different plant communities. Distinguishing the factors that maintain a plant community today can thus be problematic. However, evidence of a plant community in the precolonial landscape implies that the community is a naturally occurring vegetation type, rather than a consequence of the last few centuries of human activities. This evidence makes it easier to understand the relationships between the community and abiotic drivers such as soils and climate, as well as changing human drivers that have affected its survival, destruction or value.

Historical records provide insight into the distribution and structure of plant communities before extensive human impact on the landscape. In northwestern Virginia, 18th century land surveys included descriptions of land cover types such as marshes, barrens, and thickets. For Frederick County, almost 1000 land surveys have been plotted onto topographic maps, and all survey markers have been digitized. Using these data, we located specific land cover types. Of over 15 000 trees that were used as survey markers, 430 are associated with vegetation descriptions. Thus, we have been able to locate these land cover types in the 18th century landscape, and to relate them to tree genera/species, topography, geology and settlement patterns.

For example, a calcareous marsh, which supports a diversity of species rare to Virginia, has been present in the same Frederick County location since the mid-18th century. The community, although now fragmented, has apparently been resilient despite major local development. The 18th century data provide guidance for searching for other such wetlands, both in the specific locations given in the surveys and through the insight that historical stream names provide, e.g., Long Marsh Run. Historical data will provide critical assistance to land managers, in terms of locating these and other aboriginal plant communities as well as establishing some of the factors that maintain them.

Quantifying human land use – Sami settlement and movement patterns in northern Sweden before 1900

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Keywords: forest history, land use, archival sources, Sami, reindeer herding, spatial analysis, GIS

Northerly ecosystems place many restraints on peoples' subsistence. Low population pressure, low-productivity ecosystems and short vegetation periods have shaped unique settlement patterns and forms of utilisation. Past land use by indigenous people in these environments has mainly been studied from historical and anthropological viewpoints. One important aspect that is still poorly understood is the magnitude of the environmental impact of their communities. This presentation deals with (1) land use in interior northern Sweden in the 18th and 19th centuries – more specifically the relationship between population size, movement patterns and land use at the landscape level, and (2) the advantages and problems with using historical data in combination with modern environmental data and with spatial analyses of ecological variables.

The results show that people utilised extensive lands that featured distinct proportions of different vegetation types and that there were substantial differences in the resources they provided. Probably, these lands were originally established so that each provided sufficient resources to support the subsistence of one family – this implying a very low population density. The results also show that land use could be extensive, affecting both vegetation composition and forest structure.

Deciphering the relationships between people, their land use and the present structure and function of ecosystems require data spanning long time depths such as archival sources and archaeological records. By combining demographic data and physical land descriptions with modern environmental information quantitative estimates of human impact can be obtained. However, all approaches have limitations associated with their application to particular ecosystems and scope of use, for example choosing the appropriate time frame and sampling site, interpretation of anthropogenic indicators and archival sources may be incomplete or impossible to interpret.

Posters Session D

Plant use in native Sami societies – an analysis of past land-use in subarctic ecosystems

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Keywords: subarctic ecosystems, Sami, bark-peeling, *Pinus sylvestris*, plant food, harvesting, *Angelica archangelica*

Scandinavian northern boreal and subarctic ecosystems have been inhabited for a long time. Native Sami people have been present in the inland areas for thousands of years. Apart from reindeer herding, that emerged as an important way of subsistence sometimes during the last thousands years, little is known about the magnitude of other traditional forms of land use.

The traditional Sami diet mainly consisted of meat and fish, but gathering of wild plants was also common and an extremely important way of keeping a balanced diet. The sharply seasonal climate placed certain restrictions on gathering and storing plant food. People that inhabited these northerly regions therefore developed complex subsistence strategies that included seasonal movement, storage practices and a profound knowledge of particular plants and their qualities.

Two forms of historical Sami plant use are the harvesting of *Pinus Sylvestris* inner-bark and the use of *Angelica archangelica*. Pine inner-bark was harvested in early summer when it was sweet and tasty. A tradition of leaving a strip of live cambium to ensure the tree's survival has existed among many circumpolar people. This allows for precise dendrochronological dating of these bark-peelings.

Coring and dating bark-peelings in a late successional and protected Scots pine forest in northernmost Sweden may increase our knowledge on the spatial and temporal patterns of inner-bark harvesting. The bark-peeling activities will also be analyzed in relation to other archeological findings in the area, such as storage platforms and hearths.

To gain a deeper understanding of the extent and importance of *Angelica archangelica* as a food resource, a series of harvesting experiments in the field will be performed. By recurring harvest over three consecutive years I will examine both the quantities of wild *Angelica* that can be sustainably harvested over time and the ecological affects of this resource strategy on the plant community.

The landscape of Transylvania and of the Banat: two centuries of ecological perspective in British travel literature

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Keywords: landscape, ecological perspective, British travel literature, Romania, Transylvania, the Banat, the Danube, the Carpathian Mountains

In British travel literature dedicated to the Western part of contemporary Romania we can find an ecological perspective since the 19th century. The usual association of Transylvania with the Dracula myth can be a starting point in the analysis of the ecological perspective in British travel literature on this region. Bram Stoker decided to locate the action of his novel in a mysterious spot, in the middle of nature, and "the land beyond the forest" (as Transylvania is called in his sources) seemed to him the best choice. He read about the rich forests of the region, the mysterious mines, the unexplored caves and the unreachable heights of the Carpathians. Besides enthusiastic travellers, the landscape of Transylvania is analysed by geologists (D.T. Ansted) or chemists (Andrew F. Crosse). Andrew F. Crosse is Stoker's model for Jonathan Harker, the main character of *Dracula*. This fellow of the Chemical Society dedicates whole chapters to "the primeval forests" of Transylvania, while Charles Boner, another source for Stoker describes the subterranean world of mines and caves as an extraordinary space.

If the travellers of the 19th centuries write about the ecological aspects in a rather spontaneous way, the British travellers who write about Transylvania and the Banat in the second half of the twentieth century see the ecological perspective as a must. They criticise the change of landscape, the industrialization and the deforestation. A strong attitude is taken against the human intervention in nature which affects the ecosystem. Writing about the changes in the landscape of the Danube provoked by the construction of the Iron Gate Hydroelectric Power Station, Patrick Leigh Fermor considers that "nowhere has the destruction of historic association and natural beauty and wildlife been so great" (*Between the Woods and the Water* 242). According to Fermor, the construction of the hydro-electric power plants across the Iron Gates "turned a hundred and thirty miles of the Danube into a vast pond which has swollen and blurred the course of the river beyond recognition. It has abolished canyons, turned beetling crags into mild hills..." (241). An old road, a unique island, a city, several villages, churches, even Roman remains were covered by waters. In this situation hundreds of pages of British travel literature (both descriptions and sketches) which described the landscape and the wildlife before these changes have an archaeological importance, as the world under the water still lives in those pages of travel memoirs. The documentary value of these travel memoirs is recognised by people working in the field of Archives too. Another ecological aspect which concerns contemporary British writers is Roșia Montană. Caroline Juler in *Searching for Sarmizegetusa* is against the cyanide exploitation of the gold from the mine at Roșia Montană. She dedicates a whole chapter to this topic.

Woodland cover of the Hungarian forest-steppe in a historical perspective

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Keywords: series of reconstructed historical habitat maps, oak steppe forests, 18–20th centuries

The past extent of the natural woodland-cover of the central lowland basin of the Pannonian Biogeographical Region is still not clear. Currently we can hardly find the remains of the natural forest-steppe woodlands in this region (less than 3500 ha). Our aim was to detect, how the woodland cover change in the past. What kind of historical and social event generated processes altered the vegetation, and what kind of changes did recent socio-economic and climate changes start?

Main data sources were the I. Military Survey and its country description, the diary of the botanist Pauli Kitaibeli, 19th century written sources of botany, silviculture, and geography, present field data, oral history and further topographical sources.

An 18th century habitat map was reconstructed for 780 000 ha (Kiskunság sand ridge). Further habitat maps (2500 ha) were reconstructed for 1783, 1864, 1883, 1956. Actual habitat map were made for 1.5 million hectares (45 000 polygon). Grid-based maps were reconstructed for the 18th century to show the main characteristics of the woodlands.

In the late 18th century the area had less than 3.5% woodland cover. The most common tree was *Quercus robur*. Woodlands were open. Close to the surrounding mountains cover and closure of woodlands were higher. The most common woodland types were the hardwood gallery woodland and sand oak woodland. Totally treeless areas were also widespread. The Juniper which is today the most widespread shrub in the Kiskunság region, was very scarce two hundred years ago, but the area was rich in other shrub species. There was a big difference between the woodlands of the north and south part of the area. As a result of a land use change, generated by the European sheep boom, in the middle of the 19th century an intensive shrub encroachment started in the sand region (mostly with Juniper). As a consequence of recent socio-economic changes (end of socialism, European Union), the abandonment of land use and parallel of it a new encroachment can be detected but not only by native tree and shrub species.

Human impact and dynamics on ancient protected forests on the Southern slopes of the Swiss Alps: combining dendrochronological and eco-historical approaches.

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Keywords: dendroecology, environmental history, forest history, ancient protected forests, forest dynamics, anthracology, wood charcoal.

Current forest structure and composition is the result of long-term evolutionary processes under strong anthropogenic pressure. This is particularly the case in mountain regions where forests surrounding human settlements have played an important economic role. A precise analysis of human impact on such forest stands requires a variety of methodological approaches that take local conditions, available data sources and the time frame in question into account. For example, an eco-historical approach that takes different disciplines into consideration is needed for the time periods prior to the advent of aerial or satellite imagery and reliable statistics.

In this talk, we will discuss the suitability of combining different approaches for reconstructing the history of ancient protected forests for the period from 1700 to 1900 (i.e. banished or “sacred” forests, providing direct protection against natural hazards). In particular, we will discuss the reconstruction of the frequency and intensity of natural and anthropogenic disturbances in two study sites in the Southern Swiss Alps (Canton Ticino) through the combination of dendrochronological, historical and field approaches. Our dendrochronological and field surveys focused on local forest stands (dating of living trees and dead stumps, detection of growth releases and disturbance events in dendro-sequences, inventorying traces of human impact such as charcoal places etc.), whereas archive research focused on data found on local and regional forest management and socio-economic conditions.

Human agency in irrigation

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Keywords: irrigation, archeology, history, daily practices, modeling, agency, structuration

Irrigation is well-known for its potential for stable food production, which enabled ancient urban societies to develop, but can also be harmful to landscape and food production on the long run through salinization or increased vulnerability to droughts. I propose to study the delicate balance between success and failure of irrigation resulting from series of short-term human actions modifying the natural environment, with potential production benefits in the short run, but potential severe consequences on the long run. With irrigation resulting from a process of daily human actions over decades or centuries, we do face a problem of ambiguity of temporal scales and the importance of human agency in analyzing landscape change. Our society is not the first to challenge irrigation problems, as the archaeological record is filled with irrigation-related disasters causing societies to collapse. However, these disasters are often defined in terms of centuries. I argue that improved understanding of human agency in irrigation, its potential collapse and new human agency to avoid that, yields new, interesting questions in the debate on the collapse of ancient civilizations – and potentially our own. I will introduce two irrigation settings from two different time periods to illustrate my concepts. In the Indus Basin in Pakistan, groundwater levels drop dramatically. This current irrigation crisis is real enough, but the irony of human-induced groundwater levels is hard to miss. Since the early twentieth century, Indus groundwater levels had dramatically risen because of large-scale irrigation development by the British. About fifty years ago, rising groundwater levels were seen as main threat and tubewells were installed to lower groundwater levels. These same tubewells are now blamed for depleting the groundwater. On the Peruvian North Coast, ancient civilizations like the Chimu, Moche and Inca have created successful irrigation systems, but they continuously had to balance between success and failure. Being surrounded by desert these irrigation systems and societies show considerable changes over time, in terms of canal routing, irrigated area, building sites, etcetera. Such modifications had their short-term benefit, but also created new vulnerabilities to increasing pressure from society and environment.

Indelebile footprint of Romans in forests increases their biodiversity: a case study

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Keywords: forest, historical ecology, vegetation, Roman road, soil chemistry

Past land use is an important factor determining vegetation in temperate deciduous forests and may even contribute to present days plant biodiversity by increasing landscape heterogeneity and creating original habitats. However, little is known about the long-term persistence of these effects on vegetation. In this case study, we focused on the forest of Orléans, the largest plain forest in France (ca. 50 000 ha), which has a history of continuous forest cover since the end of Roman times. Because of the very flat relief and homogeneity of substrate (Tertiary marls and sands), the vascular plant species richness is low over the entire forest area. During the Roman times, an important road linking Orléans city to Sens city was built; it was crossing the southern part of the forest and was used until the late medieval times, after that it progressively became afforested. This case study assessed whether soil characteristics remain altered after human use of this road and if this yielded persistent differences in forest plant communities that may increase plant diversity of an otherwise species-poor forest. Phytosociological relevés were made on the former Roman road and beside it (control plots), and coupled to soil chemical analyses. Supplementary relevés were recorded over the whole forest area, using a stratified sampling design. Data analyses focused on species richness (univariate statistics) and composition (ordination, classification and indicator species analysis). We show that the soil was persistently altered on the Roman road, resulting in elevated pH, CaCO₃ concentration, but decreased C:N ratio, which translated into significant increased plant species richness, with a number of species more or less restricted to this habitat (e.g. *Arum maculatum*, *Vinca minor*, *Clematis vitalba*). We conclude that the geochemical alterations created an entirely different habitat increasing biodiversity of the forest as a whole.

Research of changing woodland areas in South-Hungary

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Keywords: forest history, Hungary, deforestation, transformation of landscape, biocultural diversity

What sort of relations can be established between the contemporary ecological status of a landscape, the system of settlements formed during centuries and the economic possibilities of the local residents nowadays? And are there any joints between the various disciplinary approaches using different sources and applying various methods? These are the questions for which the responses are sought by an ecologist and an ethnologist on the example of a southern Hungarian, protected forest area of the Eastern Mecsek hills, where a number of small and depopulating settlements are situated.

The majority of the ethnographical sources under survey belong to various types of historical documents (18–19th Century documents of estate administration, taxation lists, suits about the boundaries of land, ecclesiastical files). These sources were supplemented with recent or current interviews. We made a habitat map of the area, and studied the major dynamic features of the habitats.

The historical-ethnographical investigations pointed out that the periods of the use of landscape can be described with the changes entailed with the ownership of arable land. Especially the drastic decline of the wooded pastures can be diagnosed. In the 20th Century mining and large scale close cutting in forestry dominated the use of land. By this time former wooded pastures and arable lands were replaced by turkey oak and hornbeam oak plantations and pine-forests. From the beginning of the 21st century, local forestry management shifted to selective cutting, which resulted in a high forest cover in most parts of the area.

As a result of our joint research project we make recommendations for the local NGOs and authorities of environment protection in order to safeguard the maintenance of the landscape pattern based on human activities. The protection of such values has to be secured that were created by the work of local people, but these activities are no longer performed.

Long-term after effect of overexploitation in forests: a comparison of two ancient silvicultural systems, coppices versus “quarter in reserve”

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Keywords: coppicing, after-effect, silviculture, over-exploitation, forest, soil chemistry, vegetation diversity

The history of silviculture offers possible analogs of future forests. In the current context of an increasing demand for wood, particularly energy wood, we looked for ancient situations of over-exploitation compared to situations where the timber resource was preserved. Put in place from the sixteenth century and later formalized by the Colbert's ordonnance of 1669, the “quarter in reserve” was mandatory in all community forests of France. It consisted in setting aside a quarter of the forest area, preventing it from coppicing, in order to preserve large diameter timber for use in construction of houses and ships, in contrast to the rest of the forest, coppiced for firewood production. From the late nineteenth century, this differentiation has been gradually abandoned. Is there still a visible trace of this difference in disturbance regimes and harvesting levels in present day ecosystems, a century or more after its abandonment?

In 30 pairs of site, ancient coppices versus “quarters in reserve”, we compared plant community composition and soil chemistry. Plots within a pair were similar in stand structure (mostly over-mature coppices with standards).

The composition of plant communities still keeps track of ancient differences in silvicultural practices. In neutral contexts, with species-rich plant communities, a significantly more acidic vegetation, with more species characteristic of disturbed habitats, developed in the previously coppiced woodlands. The cause of such a difference is probably to be found in the easier penetration and persistence of species of disturbed habitats in coppices which were more often cut, with repeated and longer periods of canopy opening and regular soil mineralization pulses.

A century after the abandonment of differential practices, the environment still keeps track of previous differences in forest silvicultural treatment. With respect to changes in forest management regimes, vegetation is not very resilient, similarly to what has frequently been shown for more dramatic changes between forest and agricultural uses.

Hot spots of biodiversity in closed depressions of Northeastern France. An anthropogenic origin?

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Keywords: palynology, biodiversity, ancient forest, closed depression, Lorraine

Over 10 000 Closed Depressions (CDs) are found in silty plains of Northeastern France. These small rainfed wetlands support the growth of rare plant species and provide a dense network of habitats for amphibians. The natural or anthropogenic origin of these hollows has been debated since 150 years. However they have not been the focus of any integrated study yet.

CDs in Lorraine are most common on the Keuper marl layer but are also widespread over the calcareous layers of the Lias and Muschelkalk, and sandstone layers from the Rhetien but also from the early Triassic period. No occurrence of salt and gypsum lenses in the Keuper marl was found in 39 geological drillings in the Lorrain plain along a strip 15 km long and 1 km wide transect while more than 260 CDs were recorded using LIDAR.

We studied the spatial distribution and the topography of a set of CDs on Keuper and the age and composition in Non Pollen Palynomorphs (NPPs) and pollen assemblage of their basal sediment.

All investigated CDs have a bathtub form with a flat bottom. Several complete excavations showed a clear cut contact between the sediment and the horizontal marl substratum in the bottom of CDs, and a cut of the upper marl layers at the edges of the CDs. Radiocarbon dating from the bottom of the sediment of 10 CDs shows that the sedimentation began between the end of the Iron Age and the Roman periods. Regardless of their age and their present location in forests or pastures, the pollen composition of basal sediment layers always depicts an open landscape with a high proportion of grassland and some cropland. NPP counting's of the coprophilous fungi (*Sporormiella*-type) confirmed pastures implantation around the CDs. These convergent findings challenge the natural origin hypothesis and suggest that CDs were dug by man.

Hence, these hot spots of biodiversity have most probably been initiated by human activities. In addition, the analysis of the sediments allows to discuss how environmental changes and forest management may alter their biodiversity.

Does the landscape history influence current forest state? Drivers of change

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Keywords: coppicing, forest management, forest structure, land-use changes, socioecological processes

In the studies of European landscapes influenced profoundly by human activities for at least eight millennia, there is an urgent need to overcome the separation of natural and cultural sciences, and to integrate geography, landscape ecology and environmental history to better describe landscape socioecological processes. In our research we focused on lowland woodlands in Central European region (Czech Republic). We analyzed temporal and spatial patterns of forest change (management, structure and species composition), and socioeconomic forces behind these processes. Our goal was to relate the environmental history to the present state of forests, and to identify the driving forces of change. The main sources of information were written archival sources (since 15th century), forest, topographical and cadastral maps (since 17th century), landscape archaeological features indicating past land use and land management (e.g. woodbanks, coppice stools), aerial photographs (since 1936), and repeated vegetation surveys from 1950th to study shifts in forest understorey vegetation. Forest structure and species composition has been markedly altered under changing management regimes in the region. Traditional form of management (coppicing and coppicing with standards) varied in intensity with gradually prolonging coppice cycle – from 7 years in 14th century up to 30 years in 19th century – and fluctuating density of standards. Coppiced firewood lost its importance completely after fossil fuel became available in the 2nd half of the 19th century. Coppiced forests were left to overgrow and largely transformed into high-forests, although remnants of old coppice stools are still evident in many places. The absence of traditional management menace the continuity of historical landscape forms and features, lowers biodiversity in the shrub and herb vegetation layers, and threatens the existence of now rare and protected plant and insect species, and forest types.

Modern woodland history reconstructed from anthracological records of charcoal kiln sites in Brdy Highland, Central Bohemia

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Keywords: Central Bohemia, Brdy Highland, charcoal burning, charcoal kiln, forest history, forest vegetation, site condition

Reconstruction of former woodland vegetation in the area of the Brdy Highland (Central Bohemia) was carried out based on taxonomic identification of charcoal from 46 former kiln sites. Radiocarbon dating places 26 charcoal remains back to the 18th and the beginning of the 19th centuries. Identified charcoal taxa reflect particular ecological conditions at the localities, which is supported by agglomerative hierarchical clustering. Moreover, charcoal composition and diversity are related to an intensity of anthropogenic impact. Charcoal data show strong admixture of coniferous species such as *Abies alba* and *Picea abies* on the zonal sites. Potential natural vegetation at these sites is mainly formed by acidophilous beech forest (*Luzulo-Fagetum*). The long anthropogenic influence caused a major shift in tree species competition so that coniferous forests were supported to spread. The distribution of *Carpinus betulus* indicates a certain relation to human settlement activities. *Carpinus* has become a dominant species around villages, which show samples from a vicinity of a abandoned village Komorsko (abandoned in 15th century). Charcoal spectra also reflect the specific distribution of *Quercus petraea*, which occurred at sites of the lowest altitude and at extreme rocky stands around summits at 600 m a.s.l. Anthracological analysis confirmed former hypothesis about distribution of *Quercus petraea* based on the documents of historical forest management and recent observations.