



Cultural Landscapes – Changing Landscapes

**The International Association
For Vegetation Science:
50th Annual Symposium
University of Swansea
22-27 July, 2007.**

Delegate Handbook

We would like to express our thanks to the following sponsors of the 50th IAVS Annual Symposium



Welsh Assembly Government 'Heads of the Valleys initiative'



Croeso!

Welcome to Wales and the 50th IAVS Symposium!

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Throughout the symposium a Delegate Helpdesk will be available in the Taliesin Building.

A large map showing all venues is inside your delegate pack.

Paddy Coker – reminiscence.

Most delegates will be aware that this, Welsh, symposium would not be taking place without the efforts of Paddy Coker, whose sudden death two years ago was both a shock and a sad loss to us all. Over the course of his career, he published 4 books and almost 70 papers, on topics ranging from biogeography to computing.

He was happy to assist anyone with a genuine interest in vegetation science, proof-reading papers for those for whom English was not their first language and providing rich field experiences for his graduate students. His ability to encourage and inspire these learners, often already influential in their own careers, has done much to strengthen conservation in southern Britain and beyond.

Paddy was an enthusiastic supporter of the IAVS – especially in its ability to facilitate through its symposia both formal and informal scientific discourse among a wide range of delegates. This was, he felt, the ideal way for knowledge to be tested and shared internationally, for understanding to move forward and for new agendas to be set.

Diolch am bopeth, Paddy.

Organising committee, IAVS Wales 2007:

Hilary Thomas, [Administration Committee]

Alison McDonald, [Scientific Committee]

Nanele Lewis, [Swansea University]

Chris Davies, [Web site]

Nina Smits, [IAVS secretariat]

Charlotte Thomas, [Symposium support].

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‘At-a-glance’ programme summary

- ☘ Sunday:**
from 1400 registration,
1930 Council meeting
- ☘ Monday:**
0830 Opening session: Professor M. Barnsley
0900 Long-term vegetation dynamics [contd in pm]/ Land-use history woodlands
1730 Welcome reception ‘Taste of Wales’
19.30 Council meeting contd.
- ☘ Tuesday:**
0900 /
Beyond niche versus neutral;/Grassland diversity;
1345 Poster session, with presenters available
1415 To National Botanic Garden of Wales
1930 Editorial board meeting.
- ☘ Wednesday: 0830** Field excursions
- ☘ Thursday:**
0900 Historic landscape ecology:
anthropogenic and abiotic influences /
Plant-animal interactions then Climate change
1400 HLE contd., then Invasive species/
Effect of climate change
1730 Working group meetings
1930 Reception, Dinner and Twmpath
- ☘ Friday:**
0900 Fire, water and wind /
Restoration ecology
1400 General Assembly and presentations
1630 Swansea Symposium ends /

Cornwall excursion departs

Wednesday field excursions.

All coaches will depart from in front of Fulton House.

Please make sure that you are at your coach 5 minutes before it is due to depart:

0830:

✿ **Exc.1. Wye Valley AONB and Forest of Dean.**
Woodland and grassland, ancient managed woodland, Tintern Abbey

✿ **Exc.7. Gower.** Medieval field systems, sand dunes, grassland and estuarine marshland

0900:

✿ **Exc.2. Craig Cerrig Gleisiad, Brecon Beacons National Park.** Glaciated upland environments, cliffs, moraines

✿ **Exc.3. Dare Valley Country Park.** Post-industrial reclamation, regional biodiversity ‘hotspots’

0915:

✿ **Exc.4. Craig-y-Nos, Brecon Beacons National Park.**
Limestone grasslands under a range of management techniques

✿ **Exc.5. Nash Point, and Cefn Cribwr.** Coastal grassland, woods and scrub encroachment, *rhos* grassland

All are full-day, leaving from and returning to the university campus. A packed lunch will be available, on your coach, as part of your conference package. Risk Assessments are in place for each excursion but you should satisfy yourself that you are comfortably able to undertake your choice of excursion and should bring suitable clothing and sunscreen. If in doubt as to the excursion you are registered on, please contact the Delegate Helpdesk.

Social Programme

The evening meal has been set each day at a time to allow you to enjoy the environment of the campus or to stroll to the sea after your meal.

The following events have also been planned:

- ✿ Monday 1700 – 1845:
Egypt Centre open
1730-1830:
‘Taste of Wales’ reception

- ✿ Tuesday 1430 - 1845
Excursion to National Botanic
Garden of Wales

- ✿ Thursday 1800 - 2400:
Reception with harpist, Welsh songs,
50th Symposium Dinner, Twmpath.

JC’s bar in Fulton House will be open each evening, should delegates wish to use it.

Abstracts of presentations:

Session co-ordinatoers / chairpersons

Beyond niche vs. neutral: what we still don't know about coexistence in plant communities: Bob Peet & Jason Fridley

Ecology of invasive species: Chair - Guillaume Decocq

Effects of climate change on vegetation: Chair - Peter Glaves

Effects of fire wind and water on vegetation: Rob Marrs

Historic landscape ecology: anthropogenic and abiotic influences on the landscape: Rob Whelan

Land-use history of woodlands and the present landscape: Ulrich Deil & Thomas Ludemann

Long term vegetation dynamics linked to eco-informantics for understanding species dynamics in changing landscapes: Jan Bakker & Renée Bekker

Plant-animal interactions, especially grazing: Carsten Eichberg & Angelika Kratochwill

Restoration ecology: constraints and opportunities of ecosystem restoration - theory and practice.Laco Mucina

What factors determine grassland diversity?: Meelis Pärtel

Abstracts are provided below, organised by session, alphabetically, with oral presentations before poster presentations.

Beyond niche vs. neutral: what we still don't know about coexistence in plant communities

CRAWLEY, M.J.

Imperial College, London. UK.

An empirical definition of the regeneration niche

Coexistence requires niche differences, and Hubbell's neutral theory, based on its assumption of identical niches, does not contribute to our understanding of the mechanisms of coexistence. What can be highly important is stochasticity in both space and time, but this is not the exclusive preserve of neutral theory. Many small scale non-equilibrium processes can lead to equilibrium coexistence at larger spatial or temporal scales (e.g. in meta-populations). There are four general classes of coexistence mechanism: resource and other niche specializations, temporal heterogeneity (e.g. in regeneration niche), colonization-competition trade-offs, and Janzen-Connell spatially explicit density dependence.

GRIME, J.P. & HODGSON, J.G.

Unit of Comparative Plant Ecology, University of Sheffield, UK.

Species coexistence in herbaceous vegetation in the UK: which niches, which traits?

The recent challenge of updating a book for researchers and vegetation managers, first published in 1988, has prompted a review of theory and experimental evidence. We conclude that, to the great benefit of plant community ecology, the empirical tortoise has begun to overtake the theoretical hare. Seductive "one model fits all" solutions to coexistence puzzles are giving way to a family of mechanisms that operate singly or in combination in specified circumstances. Five of these mechanisms will be identified by reference to current experiments in old, damp, calcareous pastures in Northern England.

GRUBB, P.J.

Department of Plant Sciences, Cambridge University, UK. **Assessing the explanatory power of (1) the regeneration niche, (2) sparsity and patchiness, and (3) the seed number-seedling survival trade-off**

In the first part of the talk the topic is considered with reference to vegetation-types in which significant advances in understanding have been made in the last 30 years, notably Mediterranean-climate shrublands of the Southern Hemisphere, temperate deciduous forests, tropical rain forests, temperate grasslands, sand-dune communities and semi-deserts. In the second part I concentrate on how to falsify the hypothesis that any one of the three ideas "explains" the maintenance of species-richness.

LEPS JAN

University of South Bohemia, Czech Republic.

Mechanisms of species coexistence in wet meadows: lessons learned from a 13-year experimental study

Seminatural traditionally managed meadows are extremely species rich communities. In our experimental site Ohrazeni (Czech Republic), up to 40 vascular plant species coexist in one square meter. We have carried out several experiments to reveal the mechanisms of maintenance of this extraordinary high diversity. Mowing, fertilisation and removal of the dominant species *Molinia caerulea* were combined in a factorial design in a long-term experiment. As expected, fertilisation and cessation of mowing lead to the loss of species richness. *Molinia* has retreated in fertilised plots. In unfertilised plots, presence of *Molinia* was detrimental to species diversity in unmown plots, whereas its effect in mown plots was negligible. Even 13 years after starting the experiment, the other species were not able to replace the production of *Molinia caerulea* biomass in (both mown and unmown) unfertilised plots. This demonstrates the importance of unique trait combination of dominant species for community functioning. In a satellite removal experiment, the litter and moss layers were shown to suppress seedling emergence.

TURKINGTON, R.

Department of Botany, University of British Columbia, Canada.

Determinants of community structure: community-level consequences of species interactions and loss of biodiversity

We address two primary questions using the understorey of the Boreal Forest and adjacent grasslands: (i) how are plant communities structured, and (ii) how do they function? These questions are addressed by four major studies. First we are testing if the plant community is structured primarily by nutrient limitation, by herbivory, or by their interaction using a series of experiments running since 1990. Here we manipulate

soil nutrient levels and herbivore levels, and monitor the consequences on individual plant species, populations, and communities. Second, we are testing hypotheses about the consequences of species interactions at an individual-level and community-level. These studies were designed to determine if competition has significant impacts on community structure and if the magnitude of these impacts change in predictable ways along productivity gradients. Third, we investigate how biodiversity determines the functioning of ecosystems, by removing selected components of a plant community and observing the consequent changes in community dynamics and ecosystem function. Finally, by simulating species loss from natural systems, in conjunction with seed and seedling additions, we can determine the effect of plant species identity on invasibility of a community, and the effect of the level of the disturbance of the community on subsequent invasion.

Both the total seedling recruitment and species composition of seedlings varied much more among the four consecutive years than among individual treatments. This suggests that temporal rather than spatial differentiation of species regeneration niches might be important for the maintenance of species diversity.

WILSON, J.B.

Department of Botany, University of Otago, New Zealand. **Twelve mechanisms of species coexistence**

One of the major questions in community ecology is how to reconcile the 'Principle of competitive exclusion' with the observation that almost all of the plant communities that we see contain more than one species. I believe 12 possible explanations have been put forward, which I categorize as 1) stabilizing mechanisms, including forms of niche differentiation, environmental fluctuation, allogenic disturbance, consumer pressure and competitive networks, competition-dispersal tradeoffs, cyclic succession, and initial patch composition; and 2) equalizing mechanisms, including neutrality, mass effects, spatial and temporal inertia, and competitive coevolution. I shall discuss the likelihood of each mechanism and the evidence for them. Finally I shall discuss which are the most important in the real world, concluding that we have yet little idea.

Long term vegetation dynamics linked to eco-informatics for understanding species dynamics in changing landscapes

BAKKER, JAN P., BEKKER, RENÉE M

Community and Conservation Ecology Group, University of Groningen, The Netherlands

From long-term vegetation dynamics towards ecoinformatics

Permanent plot studies are the backbone of revealing long-term vegetation dynamics. Additional experiments in chronosequences are needed to understand mechanisms behind the observed dynamics, including life-history traits of plant species. Moreover, data on the occurrence of species in space and time are important (i.e. present and past species pools). In the Netherlands huge databases are fed by scientists and c. 18,000 volunteers. These data will be used by the government in order to deal with the demands on our scarce space for different forms of land use and in the same time comply to the framework of EU Directives for nature conservation. In 2007, the Dutch government appointed an officer for the quality assessment of the data, and supported him with 20 Euro. In the near future a Netherlands Ecoinformatics Network will further elaborate on the databases to ensure better prediction in space and time of the occurrence of species with changing land use. Also scientific breakthroughs are anticipated by combining databases of life-history traits, including dispersal and abiotic conditions to establish assembly rules, and on the co-occurrence of plants and animals.

BEKKER, RENÉE M., DÜTTMANN, HEINZE, DE VRIES, YSAAK & BAKKER, JAN P.

Community and Conservation Ecology Group, University of Groningen, The Netherlands.

30 years of hay meadow succession without fertilization: what happened to plants, birds and soil fauna composition?

In the present study we investigated the effects of hay meadow succession in the brook valley system of the Drentse A Nature Reserve, in the NE of The Netherlands. In particular, we compared the plant and soil fauna composition in five grasslands that differed in the stage of vegetation succession in a well-studied chronosequence. The sampled grasslands include a control site (still fertilized meadow), a 5, 15, 25 and 32 years

stage of vegetation succession after the cessation of fertilizer application. At all sites, vegetation and soil fauna components were studied in ten replicate subplots of 4 m² each. Moreover, the breeding birds have been monitored in the area over the last 28 years by mapping territories overlapping the grasslands of the chronosequence. Where plant biodiversity increased, earthworm density declined and we could find obvious changes in the breeding bird community. In particular waders such as Lapwing (*Vanellus vanellus*) and Blacktailed Godwit (*Limosa limosa*) disappeared completely from the area and were succeeded by Curlew (*Numenius arquata*), and Snipe (*Gallinago gallinago*) which are currently rare in the area.

CORDLANDWEHR, V., VAN DEN BOOM, B.W.A.F.H., OZINGA, W.A. & BEKKER, R.M.

Community and Conservation Ecology Group, University of Groningen, The Netherlands.

Plant trait attributes of the resident community and local soil conditions as predictors for the occurrence of species of the *Calthion palustris* alliance

Abiotic and biotic filters affect the local species composition of plant communities. As a consequence we can observe non-random patterns of species distribution in natural systems. To be able to make detailed predictions of species co-occurrence on a focal site we need to know the role different filters play. Within the fen meadows of our study area, the Drentsche A Reserve in The Netherlands, species are not equally distributed and one can observe clear spatial patterns in the occurrence of the typical *Calthion* species. Since the beginning of the 1970s large parts of the present reserve have been managed by the State Forestry Commission, with mowing in July without fertilizer application. As mowing machines are a moving dispersal infrastructure connecting large parts of the reserve, we assume that dispersal within the reserve is not limited. To find an explanation for the fact that our focal species do not occur at sites where we expected them, vegetation recordings as well as soil analyses were carried out in 2002. This was done at 76 small plots spread along a three km long part of the Drentsche A brook valley. Combining these data with plant trait data, we show the relative importance of soil conditions and trait attributes of the co-occurring species on the presence-absence patterns of focal species. This study focuses on the question whether the local distribution of species of the

Calthion palustris alliance can be explained by a combination of environmental conditions, such as soil characteristics, and biotic conditions, i.e. the trait composition of the community.

HEIRI, CAROLINE & BUGMANN, HARALD

Forest Ecology, Institute of Terrestrial Ecosystems, ETH Zurich, Switzerland

Forty years of natural succession in Swiss beech forests: driven by site conditions, light or past management regimes?

Natural forest dynamics have become an important topic, not only for achieving an economically and ecologically sustainable forest management but also for biodiversity and nature conservation. However, little is known about the natural long-term development of forests in Western Europe; most of these forests were influenced strongly by management for many centuries. Therefore studies on unmanaged Western European forests are few, and many of the available studies are based on a single forest, which is the result of successional processes and a sometimes peculiar management history. This makes it difficult to gain a general understanding of natural forest dynamics. For our study, we used a unique data set covering 40 years of forest inventories from 6 forest reserves in the Swiss lowlands to investigate the natural dynamics of beech forests 80 to 100 years after management has ceased. Even though the forest compositions at the beginning of the investigation period differed strongly between the 6 forest reserves, the temporal development in species abundances show an overall trend towards dominance by European beech, a shade-tolerant late successional tree species. This suggests that competition for light is the main driver of succession, whereas the initial state of the stands is influenced very strongly by past management regimes, and to a lesser extent by differing site conditions.

KAMMERMEIER, SABINE & BRUELHEIDE, HELGE

Institute of Geobotany and Botanical Garden, Martin Luther University Halle Wittenberg, Germany

Slow growth, fast changes: gap dynamics of a montane spruce forest.

In a near natural spruce forest in the Harz National Park (Central Germany) we asked whether the low growth rates of conifers in the montane forest belt are reflected in lower gap dynamics and a reduced regeneration of *Picea abies* individuals. We hypothesised that (i) gap

dynamics in native montane spruce forests are lower than in other temperate forests, (ii) gaps are crucial for regeneration and (iii) within gaps, regeneration is dependent on disturbance-induced microsites. The total gap area varied between 14.5 and 26.4 ha for the different years. Mean gap size ranged between 195.7 and 600.9 m² and gap frequency between 2 to 4.3 gaps per hectare. For the whole study area we calculated a turnover rate of 0.25 % /yr for a period over 58 years. In general, the most frequent gaps were smaller than 100 m². On the plot level, regeneration varied significantly between closed forest matrix and gaps of different age. On the subplot level, regeneration was positively related to the occurrence of moss-covered rocks, where spruce juveniles were higher, had a greater basal diameter and more whorls than on other microsites. Herbivory by red deer was lowest on elevated parts of root plates. However, regeneration was less dependent on those microsites produced by gap dynamics but more on those already existent before the disturbance event. It can be concluded that gap dynamics at Mt. Brocken are comparable to other forest types and that gaps are essential for forest regeneration. We predict a change in stand structure with a trend towards lower average tree age.

KATTAL, KAILI & SAMMUL, MAREK

University of Life Sciences, Tartu, Estonia.

Plant functional traits determine the dynamics of species-rich wooded meadow community in 25 years of recovery from 20 years of fertilization

We use the data from a long-term experiment to estimate how plants with different functional and life-history traits react to fertilization (20 years) and recover after the cessation of fertilizer application (25 years) in a species-rich semi-natural meadow. Our data shows that abundance of competitive species increases while abundance of stress-tolerant species decreases with increasing nutrient load. After the end of fertilization the decrease of abundance of those plants which gained during fertilization is quicker than the increase of abundance of plants which suffered due to increased competition during fertilization. Hence, there is a uniform inertia of changing abundance of different species groups, which strongly influences vegetation dynamics. We will evaluate which species traits contribute to the plants' response to changing environmental conditions. We will show that during fertilization, when the whole vegetation shifts towards more competition, the traits that relate to growth and competitive

ability affect whether the species falls into the category of species gaining or decreasing in abundance. However, after the cessation of the fertilization traits of sexual reproduction, spread, and vegetative propagation gain importance. Hence, the dynamics of a population is determined by varying traits during different successional phases.

MANTHEY, MICHAEL

Institute of Botany and Landscape Ecology, Greifswald University, Germany.

Cross-continental niche comparison of large woody species: does competition matter?

Classical niche theory predicts decreasing niche widths with increasing species packing due to increasing interspecific competition. We tested this assumption by comparing niche widths of large woody species using matched datasets from southeastern North America and southeastern Europe that differ strongly in tree species diversity. For the quantification of habitat specialization (i.e., relative niche widths) we used a recently developed method that is based on species co-occurrence data. The main idea is that generalists should co-occur with many species, (high species turnover), whereas specialists should co-occur with relatively few species, given equal plot occurrences. We quantify this concept using a dissimilarity measurement-based statistic that places species along a generalist-specialist gradient. The results of our cross-continental comparison do not support the hypothesis mentioned above. Despite a twofold higher diversity of large woody species in southeastern forests of North America, there is a surprisingly strong agreement in the distribution of niche widths between the compared regions. Thus, interspecific competition seems to play only a minor role in the development of realized niches of large woody species in temperate forests.

MUCINA, LADISLAV

Stellenbosch University, South Africa.

Afrotropical Forests of South Africa in Evolutionary Perspective

Afrotropical (also known as afro-montane) forests of South Africa were classified using plot-based floristic data. The floristic composition and a number of biogeographically important genera (*Ilex*, *Ocotea*, *Podocarpus*, *Prunus*, *Rapanea/Myrica* etc.) suggest close links between these forests and the evergreen sclerophyllous forests of various warm-

temperate regions experiencing similar climatic patterns of the World (southeastern China, southernmost regions of Korean Peninsula, southern Japan, *laurisilva* of the Canary islands, *Podocarpus* forests of northern Argentina and the evergreen forests of southeastern USA etc.). The phytogeographic relationships between the afrotemperate forests, their analogons on other continents and so called montane tropical rainforests are discussed in palaeoecological and evolutionary perspectives. A research agenda into origins and past dynamics of the afrotemperate forests using molecular-phylogenetic and phylogeographic methods as well as studies into life-history syndromes of the dominant species of the afrotemperate forests is outlined.

NATLANDSMYR, BRITH

University of Bergen, Norway.

Overgrowth of abandoned hay meadows and pastures by *Alnus glutinosa* in western Norway

Thirty years of vegetation changes in *Alnus glutinosa* swamp woodlands in Bergen, western Norway were studied. These woodlands are former hay meadows and pastures that were abandoned at different times between 1950 and today. Samples of vegetation and environment in 1975, 1995 and 2005 were compared using classification, ordination and statistical methods. The species composition in the three sample years differed significantly, indicating a development from wet hay meadows and pastures with scattered *Alnus glutinosa* trees, towards denser *Alnus glutinosa* woodlands, and later towards woodlands containing also other tree species. As expected, the field layer was less dominated by light demanding species in 1995 than 1975, though this trend did not continue in 2005. At the same time the cover of forest species has increased. The amount of moisture demanding species decreased significantly from 1975 to 1995, probably due to the draining effect of a denser tree layer. Later this effect seems to have flattened out. Increasing nitrogen indicator values from 1975 until 2005 indicate nutrient accumulation after cessation of grazing and mowing.

OZINGA, WIM¹, SCHAMINÉE, J.H.J.¹. & VAN GROENENDAEL, J.M.².

1. Alterra, Wageningen University and Research Centre, Wageningen, The Netherlands; 2 Radboud University, Nijmegen, The Netherlands

Seed dispersal as a key to species losses in NW Europe: Can ecological restoration reverse the trend?

Insight into factors that determine the assembly of plant communities from a given pool of species is of paramount importance for conservation ecology. We analysed the importance of niche-based processes and dispersal processes for explaining plant losses in The Netherlands during the 20th century. We followed an "eco-informatics" approach by combining large databases containing floristic, phytosociological and functional information. For the floristic information we used the National Floristic Databank (Floron), which comprises more than 7 million records. The National Vegetation Databank (containing about 480,000 vegetation relevées which are integrated in the expert system SynBioSys NL) and the LEDA traitbase (with 25 traits for the Northwest European flora) formed the basis for the functional analysis. Our premise was that differences in the nature of the species in local and regional species pools with regard to functional traits can give important clues to the processes at work in the assembly of communities. Our results indicate that changes in dispersal processes are as important as the more commonly accepted changes in habitat quality in explaining species losses. We will discuss some restoration efforts in The Netherlands.

PILLAR, VALÉRIO D., SOSINSKI, ENIO E., DUARTE, LEANDRO DA S., CARLUCCI, MARCOS, B. & BLANCO, CAROLINA

Laboratory of Quantitative Ecology, Universidade Federal do Rio Grande do Sul, Brazil.

On the problem of scaling plant functional traits from individuals to communities

We offer a simple and flexible methodological framework to analyse trait-based data sets with the objective of scaling functional traits and types across levels of biological organization. The analysis takes a matrix B of individuals or species populations by traits, another matrix W with the performances (qualitative or quantitative) of these individuals or populations in communities, and a third matrix E describing the community sites by environmental factors or ecosystem effects. Cluster analysis of B defines a matrix U with degrees of belonging (u_{ig}) of each individual or population to plant functional types (PFTs), which will be crisp if $u_{ig} = 0$ or 1 , or fuzzy if u_{ig} is in the interval $[0, 1]$. By matrix multiplication and proper weighting, $X = U'W$ will contain PFT

composition of communities and $T = B'W$ the trait means in the communities. Both X and T can be related to E by matrix correlation or linear models. Existing iterative methods can search for an optimal trait subset and group partition taken from B to maximize the relationship between E and X or T . We use as example trait-based data of woody species colonizing *Araucaria* forest patches of different sizes in a forest-grassland mosaic in south Brazil and explore the advantages and complementarities of scaling into X or T to study the role of disperser attraction traits and seed size number trade-off in the colonization process.

THEVS, NIELS

Institute of Landscape Ecology and Botany, Greifswald University, Grimmer Strasse 88, 17487 Greifswald, Germany.

Vegetation and landscape dynamics in the extremely arid Tarim Basin, Xinjiang, China

Under the extremely arid conditions in the Tarim Basin, as well as in the Aral Sea Basin, the vegetation is concentrated along rivers (Tugai vegetation). Most of the Tugai vegetation has been destroyed by logging and indirectly by diverting water from the rivers. The middle reaches of the Tarim River, Xinjiang, China, harbour one of the last near- natural riparian Tugai vegetation complexes along an unregulated river stretch. Tugai forests continuously tap the groundwater, rather than save water. Currently, the Tarim River is regulated in order to provide water to the drought prone lower reaches of the Tarim River. Lateral river dykes have been constructed along most of the Tarim middle reaches and weirs are proposed to be constructed. This work aims at investigating the impact of the Tarim regulation on the Tugai forests and other riparian ecosystems and present ideas for their future conservation. Forest distribution and ecology and recruitment of the key-species *Populus euphratica* were investigated. The results reveal that river dynamics plays a crucial role for the generative recruitment of Tugai forests, e.g. conservation of genetic diversity. Stable groundwater fed by river courses only can sustain existing Tugai forests without the existence of any vegetation dynamics.

VAN ETTAN, EDDIE J.B.

School of Natural Sciences, Edith Cowan University, Australia.

Assessing the Conservation Status of Vegetation: Problems and Progress

Assessment of the conservation status of vegetation units is becoming a standard component of environmental impact assessment in Australia and elsewhere, and is closely aligned to legislation, policy and practice of identifying and protecting threatened ecological communities. Such practices are more difficult than is widely appreciated (perhaps because vegetation scientists are rarely involved in the process) and force us to revisit many of the fundamental conceptual conundrums of vegetation science (such as continuum versus community, appropriate levels of abstraction, and suitability of classification methodology, to name a few). This paper will summarise these difficulties as well as providing some potential solutions based on the author's experience in vegetation assessment in arid Western Australia. In particular, the contribution of climatic gradients and stochastic variation in species distributions to 'within-habitat' species turnover will be highlighted, as an integral factor to be considered when deciding on appropriate levels of abstraction. Levels of such turnover in arid Australia appear high and will be demonstrated using a variety of measures, including plotting of species similarity measures with geographic distance, gradient analyses, and testing for differences between vegetation units based on geographic locality. An essential component of assessing conservation significance is determining how common the vegetation unit is in the surrounding landscape or region. Techniques for doing this, especially in the absence of detailed vegetation mapping, will also be discussed. Lastly the legal ramifications of these fundamental questions will be considered.

WAMELINK, G.W.W., VAN DER GREFT, J., FRANKE, J., JOCHEM, R., PRINS, A.H., VAN DOBBEN, H.F. & GRASHOF-BOKDAM, C.

Alterra, Wageningen University and Research Centre, Wageningen, The Netherlands.

Dispersion of plant species in a scattered landscape on a regional scale; a modeling approach

Due to human activities, natural landscapes have become isolated. As a result the dispersal of plant species is hampered. The goal of this research is to develop a model that is able to simulate the plant species dispersion in a scattered landscape on a regional to European scale and to apply this model for several species. We developed a spatially explicit dispersion model (DIMO) based on dispersion capacity. Barriers, such as roads and rivers as well as unsuitable vegetation types, are affecting the dispersion

speed. Spatially explicit data about current and past occurrence of species is based on inventories. From the inventories, the presence of a viable seed bank is derived. First model runs show that plant species, depending on their dispersal capacity and their presence in a seed bank, may become isolated and are not able to reach new suitable habitats due to the lack of connectivity of the landscape. Populations that are not large enough may become locally extinct. This process may be enhanced due to climate change.

ZOBEL, MARTIN, ÖPIK, MAARJAPIK & MOORA, MARI

Institute of Botany and Ecology, University of Tartu, Tartu 51005, Estonia.

Species mobility and coexistence – are there any 'rules' we do not know yet?

Although the mechanisms underlying non-random coexistence patterns of plant communities have been examined for over a century, little is known about the role of clonal growth in generating these patterns. We studied the variation in annual rhizome increment and community-wide Clonal Mobility (sum of average annual mobility of species weighted with their relative cover) in a coniferous forest, represented by young and old stands. The observed pattern of CM indicates the differential response of plants with different growth forms to disturbance, in terms of annual rhizome increment and different representation of them in old and young stands. We propose a distinction between two kinds of species in perennial plant communities. Matrix forming species (hemirosette- and rosette-forming species), exhibiting limited clonal mobility, represent a stable component of the community. 'Running-around' species (erosulate forbs) represent the mobile component of plant communities, consisting either of species with high vegetative mobility or species regenerating from seeds. These species respond rapidly to disturbances and may decline or perish temporarily and afterwards re-colonize the space between matrix forming species. We propose that within a given species pool, coexistence of species within a limited space is determined by their spatial mobility and by the time since disturbance.

Poster presentations –

Mahdavi, P., Akhiani, H., Noroozi, J., Zarrinpour, V. & Najafi, A.A.

School of Biology, College of Science, University of Tehran, P.O. Box 14155-6455, Tehran, Iran

Diversity and vegetation change in natural, semi-natural and man-made landscapes from semi-desert to alpine zone of Tehran metropolis and Tuchal Mountains (Iran)

“This study focuses on long-term vegetation sampling with 1178 relevés along a transect from South of Tehran to the alpine peak of Tuchal Mountains (1000-3966 m). The main plant communities were distinguished using multivariate analysis. The DCA ordination clearly divides the vegetation units along altitude and humidity gradients. The Shannon diversity index indicates that diversity is generally decreasing at increasing altitudes. The most diverse groups are concentrated in low altitude *Artemisia sieberi* steppe followed by the alluvial undulating hills in the centre of Tehran and piedmonts dominated by *Stipa* spp. and *Astragalus microcephalus*. In this zone intensive degradation, disturbance, and artificial plantation cause the spread of several weedy species. The lowest diversity was found in snowbed, rocky and scree habitats of the high alpine zone of the Tuchal Mountains. The moderate diversity was documented in the montane zone between 2000-3000 m. The reason for decreasing of diversity in higher altitudes is interpreted by the shorter growing period, decreasing temperature, thin and poorer soil and water-holding capacity. The results show that disturbance does not increase diversity in semi-arid open communities. This is explained by the fact that the plant species in semi-arid open habitats have been adapted to using diverse and narrow available niches”.

Salmina, Liene

Institute of Biology, University of Latvia, Riga, Latvia.

Limnogenous mire vegetation of Latvia

“The aim of the study was to prepare the syntaxonomical structure of limnogenous mires of Latvia. The mire plant communities formed in the process of lake terrestrialization including the first succession stage represented by tall sedge stands and *Myricetum gale* and *Schoenetum ferruginei* found in the drained part of lakes in Latvia were considered as limnogenous mire communities in this study. For data analysis 1582 relevés were used; transitional mire, fen, tall sedge and fringe vegetation were distinguished. Cluster analysis was used for classification and 20 associations were distinguished according to the Central European vegetation classification approach. Diagnostic species of four alliances

and 20 associations were determined by means of indicator species analysis. *Caricetum rostratae* and *Caricetum lasiocarpae* were the most common limnogenous mire communities in Latvia, while *Myricetum gale*, *Cladietum marisci*, *Schoenetum ferruginei*, and *Caricetum buxbaumii* were the rarest ones, found mainly in the Coastal Lowland. The analysis of phytogeographical spectra showed that circumpolar species dominate in all limnogenous mire communities, except *Schoenetum ferruginei* supporting many species found only in Europe. Limnogenous mire communities were also characterized by the lack of temperate-submeridional and submeridional species and the dominance of polizonal species”.

Laivins, Maris 1, Salmina, Liene 2 & Kreile, Vija 3

1,2 Institute of Biology, University of Latvia; 3 Teici Nature Reserve, Aiviekstes street 3, Laudona, Madona District, LV-4862, Latvia.

Oak and hornbeam forest communities of Latvia

“Oak and hornbeam forest vegetation in Latvia was studied. Oak dominated forests are found throughout Latvia, while hornbeam forests occupy only small areas in the southwest part of Latvia. For data analysis 161 relevés were used. Six end clusters were obtained using cluster analysis and the following plant communities were distinguished: 1) *Quercus robur* - *Calamagrostis arundinacea* community; 2) *Quercus robur* - *Pteridium aquilinum* com-y; 3) *Carpinus betulus* - *Tilia cordata* com-y; 4) *Quercus robur* - *Acer platanoides* com-y; 5) *Quercus robur* - *Silene dioica* com-y; 6) *Quercus robur* - *Fraxinus excelsior* com-y. Indicator species analysis was used to describe the plant communities. The syntaxonomical affinity of the plant communities and the impact of site topography to floristical differences of plant communities are discussed”.

Wamelink, G.W.W., Goedhart, P.W., Frissel, J.Y., Wegman, R.M.A., Slim, P.A. & Van Dobben, H.F.

Alterra, Wageningen University and Research Centre, Wageningen, The Netherlands.

Estimation of association responses for soil pH

In vegetation assessment, vegetation modelling and the estimation of critical loads Ellenberg indicator values are still widely used, despite major drawbacks. Based on the response of the species to soil pH we estimated the response of the syntaxa, from class to sub-association level.

To this end, we used a dataset of 160,000 syntaxonomically identified relevés. For each relevé, we calculated the expected pH value as the mean of the pH optima of the species present. Response curves per syntaxon were estimated based on the estimated pH values per relevé. Percentiles values were used to define amplitudes per syntaxon. We were able to estimate a response for almost all associations occurring in The Netherlands. Regression to the mean causes contraction of the response axis. We offer a solution by directly estimating the optima of a small number of associations with sufficient data, and using this to correct the indirectly estimated optima and percentiles. The lower pH percentiles can be used as a minimum value for the occurrence of the association, e.g. to determine the critical load for acid deposition.

Land-use history of woodlands and the present landscape

BAETEN, LANDER¹, HERMY, MARTIN² & VERHEYEN, KRIS¹

1 Laboratory of Forestry, Ghent University; 2 Division of Forest, Nature and Landscape Research, University of Leuven, Belgium.

Recruitment limitation of herbs colonizing recent forests: results of an introduction experiment (2000-2007)

Interspecific differences between forest understorey herbs in their capacity to recolonize secondary forests can be attributed to both dispersal and recruitment limitation. In case of secondary forests established on former agricultural land, recruitment limitation can result from differences in habitat quality because of the persistent changes of soil properties (e.g. phosphorus availability). To eliminate dispersal limitation and to assess recruitment and growth of forest species differing in colonization capacity, seeds and adults of two fast- (*Geum urbanum*, *Ranunculus ficaria*) and two slow- (*Anemone nemorosa*, *Primula elatior*) colonizing forest species were introduced into ancient and recent forest sites in 1999. Verheyen & Hermy (JVS 15: 125-134), presenting results of two growing seasons following the introduction, demonstrated that germination of seeds and survival of adults was not affected by land use history, indicating that habitat quality is not a limiting factor. Plant performance, on the other hand, was significantly enhanced for the two hemicryptophytes (*P. elatior*, *G. urbanum*) taking advantage of the increased nutrient availability, but remained unaffected for the two

geophytes (*A. nemorosa*, *R. ficaria*). A short monitoring period, however, does not provide reliable information on the effects of habitat quality on the establishment of species. In this study, results on recruitment and survival of the transplants eight years after their introduction will be presented and compared to the earlier findings.

BERGMEIER, ERWIN

Albrecht von Haller Institute for Plant Sciences, University of Goettingen, Untere Karspüle 2 D-37073 Göttingen, Germany.

Regeneration of natural forests vs. Preservation of agro-silvopastoral systems – A conservation dilemma with both ways to go?

The oak forest of Folói (Peloponnese, Greece) has existed since antiquity, and it is unique as the southernmost extensive old-growth *Quercus frainetto* forest. Field studies on species composition and environmental relations were carried out in wood pastures, exclosures, and arable fields scattered within the woodlands. GIS analyses of sets of aerial photographs since 1945 revealed changes in structural-physiognomic and land use features. While the total forested area decreased only slightly in the course of the second half of the 20th century, the number and proportion of open stands increased, at the cost of dense forest stands. The forest provides excellent examples of both a largely intact submediterranean oak forest, with the potential of becoming even more natural with respect to a balanced tree age structure, and also a traditional agro-silvopastoral system, worthy of preservation for its structural and biological diversity, and cultural heritage. The case of Folói is discussed as an example of tensions between conservation efforts towards more natural and more diverse systems in traditionally managed woodland environments.

JAMONEAU, AURÉLIEN, MORON, EMILIE, CHABRERIE, OLIVIER, CLOSSET-KOPP, DÉBORAH & DECOCQ, GUILLAUME

Department of Botany, University of Picardie Jules Verne, 1 rue des Louvels, 80037 Amiens Cedex, France.

Forest patch changes among contrasted agricultural landscapes of the Picardy region (N France) since the late 18th century

Historical factors have long been recognized as major controls on current forest plant diversity. However, few studies investigate how landscape dynamics may influence plant diversity at the forest patch scale. In this

study, we compared directions and rates of forest change between three sets of three landscape units: open-field, bocage and large forest tract. For this purpose, we digitalized old maps and aerial photographs using a Geographic Information System. Landscape changes were interpreted using both natural (e.g., climate, substrate, slope) and socio-economical (e.g., population density, agriculture) factors. For each landscape unit, we also reconstructed the forest flora of the late 19th century using botanical archives. The current forest flora was extracted from the DIGITALE flora databasis and field surveys. Finally, we tried to relate the dynamics of plant species pools to landscape changes over the last century.

LUDEMANN, THOMAS

University of Freiburg, Schaenzlestr. 1, D-79104 Freiburg, Germany.

Drawn by nature – Spatial patterns of past wood exploitation and their dependency on the natural forest vegetation

In the present landscape charcoal remnants of past human activities are widespread. Their systematic anthracological analysis provides new and unexpected results for vegetation science. We have analysed remnants of historical mining and charcoal burning from the Black Forest (SW Germany) and neighbouring regions, with special regard to the natural diversity of growth conditions, forest vegetation and tree species composition. The relations of past fuel wood exploitations and the ecological conditions of the exploited forests are delineated by landscape sections of different spatial scales. All of the tree species to be expected for the natural conditions were exploited in the past. The individual sample sites show considerable differences in tree taxa composition, from which regular spatial patterns of the past tree species distribution have been deduced. These patterns are well explained by local and regional differences in the ecological conditions of the exploited forests. A pronounced dependency of the fuel wood exploitations on the natural distribution of the tree species is discernible. Moreover, species composition and diameter of the used wood often indicate the exploitation of close-to-nature non-degraded forest stands in the past.

MANEGOLD, MELANIE

University of Freiburg, D-79104 Freiburg, Germany.

Indicator value of vascular plant species and cryptogams for land-use history in mountainous ancient woodlands

Several studies in temperate broad-leaved forests in European lowlands revealed differences in the floristic composition between ancient woodlands and forests formerly used for agricultural purposes. Some plant species show a strong affinity to either ancient woodlands or newly founded forests and are therefore considered as indicator species for such forest types. The present study determines whether the concept of floristic differences due to former land-use and the occurrence of indicator species can be transferred to the spruce-dominated mountainous forests in the Black Forest in southwest Germany. Vegetation surveys were done and several site parameters were collected on more than 160 plots, in forests with definitely known land-use back to the 18th century. Analyses of floristic data show only minor differences in the floristic inventory due to different land-use history. Vascular plant species composition is very similar in all investigated forests. Some differences can be noticed by taking into account the coverage of certain species. Other parameters such as composition of cryptogams, soil characteristics or soil seed bank seem to be better indicators for the land-use history of today's forests in the Black Forest.

MÜLLER, ANUSCHKA

University of Freiburg, D-79104 Freiburg, Germany.

What did the Black Forest look like before the charcoal burners arrived in the 18th century? An anthracological contribution to the reconstruction of the former forest vegetation in the Black Forest, Germany

In the Black Forest (Germany), charcoal production in kilns has been an important process during the last centuries. Together with other wood consuming industries, it led to an overexploitation of forest stands until the 19th century. Charcoal remnants from historic kiln sites were used in several studies to determine the former tree species composition. The aim of this study is to obtain detailed information about the kind of wood used and its former growing conditions. Having this information, it is possible to tell whether the forests were intensively used before the start of the charcoal production. Fir (*Abies alba*) is used as an example to compare the tree ring structure of charcoal samples from several historic kiln sites in the Black Forest. A decision tree model was developed, to distinguish between branch and stem material. A discriminant analysis with two variables (mean tree ring width, number of tree rings) reproduced up to 94% of the results of this model. At some sites, most of the charcoal

samples are branch material, whereas at other sites, stem material dominates. In addition, the mean tree ring width shows significant differences between sites with different habitat conditions. At sites where predominantly stem material was used, one interpretation is that the charcoal burners used a mainly unmanaged and naturally grown forest.

SUFFLING, ROGER & SCHMITT, DAVID

The School of Planning, University of Waterloo, Waterloo, ON N2L 3G1, Canada.

The cultural context of Southern Ontario Woodlands

The woodlands of much of Eastern North America, including southern Ontario, should be understood as part of a cultural landscape. The dominant urban and agricultural matrix of southern Ontario is a novel landscape with remnant woodlands embedded in it, but such remnants are regarded by many land managers as representative of a previous wilderness landscape. However, historical ecological studies demonstrate that these forests are profoundly affected by native and European agriculture and harvesting, by modern urbanization, by introduced species, and by exogenous processes that include nutrient enrichment and acid rain. Thus these woodlands change in unpredictable ways, as envisaged in the new ecological paradigm: For most Southern Ontario woodlands there is no single, predictable ecological pathway, and no final stable state. Research requirements for Southern Ontario's woodlands are identified using this perspective.

WULF, MONIKA

Leibniz-Centre for Agricultural Landscape Research (ZALF) e. V., Department for Land Use Systems and Landscape Ecology, Eberswalder Strasse 84, D-15374 Müncheberg, Germany.

Alteration of a landscape in northern Germany: human impacts on the woodland-field-distribution since 1780

Historical and current maps (1780, 1830, 1880, 1935 and 1980, scale 1:100.000) of the Prignitz (330.000 ha) were digitalized. The intersected maps demonstrate extensive clearings especially between 1780 and 1830. However, around 1780 the amount of forest was 34%, had decreased to 20% in 1880, but increased again to 23% in recent times. The tree composition has changed dramatically, since deciduous trees spread until halfway through the 18th century, but were quickly replaced by pine trees during the course of the 19th and 20th century. Today, deciduous tree

stands are very small and pine trees have a presence greater than 85%. The land register of the 17th century provides evidence for wood pasture in the entire Prignitz, which has favoured oak trees compared with beech trees. It explains the predominance of the oak tree until halfway through the 18th century. The use of litter was seen particularly in the 19th century, usually, however, only in pine stands on poorer and drier sites. The intensive use of woodland areas might, besides site-related reasons, be the cause for the relative species poverty of woodlands.

Poster presentations -

Micháľková, Daniela & Soldán, Jakub
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Environmental factors affecting dry grassland vegetation in the Western Carpathians and Pannonian region (Central Europe)

“The analysis of 128 phytocoenological relevés of dry grassland vegetation (*Festuco-Brometea*) from the Western Carpathians and Pannonian region (Slovakia, Hungary, Czech Republic) is presented in this study. The vegetation belongs to the alliances *Festucion valesiacae*, *Bromo pannonici-Festucion pallentis* and *Asplenio-Festucion pallentis*. The classification was performed in PC-ORD and aimed at the distinction of associations. Some environmental variables were analysed to characterise the habitat conditions of the vegetation types: soil parameters (pH, amount of carbon, nitrogen, phosphorus, calcium, potassium and humus), potential annual direct irradiation, altitude, inclination of the slopes and Ellenberg indication values. We also studied the representation of plant growth forms in the individual associations. Using the programs ArcGIS and CANOCO, the influence of bedrock type, soil type, mean annual precipitation totals and temperature were interpreted. The effect of the measured environmental factors upon the variation in the studied vegetation was tested by direct ordination methods. This work was supported by the grant agency VEGA, grant No. 2/5084/25”.

Historic landscape ecology: anthropogenic and abiotic influences on the landscape

DEIL, ULRICH

Department of Geobotany, University of Freiburg, Schaezlestr. 1, D-79104 Freiburg, Germany.

Sacred groves in Morocco – vegetation mosaic and biological value

In the Maghreb countries, the surroundings of Muslim saint tombs, used as burial ground by the local people, often shelter the last remnants of forest vegetation in intensively cultivated regions. Within the holy territory plants and animals became protected without being the actual object of protection, but by playing an important role for the identity of tribal groups, for genealogy and myths: the noosphere (imagination, intellectual world) becomes tangible in the biosphere (organisms' world). After a brief introduction into the traditional saints, cult and pilgrimage practises in Morocco, the results of a geobotanical case study of two graveyards in Northern Morocco (Tangier Peninsula) are presented. The sacred grove-sites are characterised by a fine-grained vegetation mosaic which partly originate from multiple forms and intensities of moderate use (pasturing, small-scale burning, grave digging). They are of outstanding biological importance and of aesthetic and spiritual value. Finally, the potential role of sacred grove sites in nature conservation and their long-term conservation perspectives dependent on land use practises and the socio-cultural context will be discussed.

CORPORAAL A.* & SCHAMINÉE. J.H.J.

Alterra WUR /Radboud University Nijmegen

Survival mechanisms of *Fritillaria meleagris* in Northwest European floodplain meadows

Fritillaria meleagris grows within the reach of rivers having the flooding regime of a rain water system. Germination is optimal on intermediate sandy clay and loamy soils. On heavy clay soils, the species flowers in only small numbers

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and the quality of the seeds is rather bad, while on sandy soils the drought of the soil top layer prevents germination. As a stress-tolerant ruderal, the species does hardly invest in a seed capital (the yearly seed output is rather small). However, it becomes very old and uses the scarcely occurring small and local disturbances to germinate. Such disturbances were once common within the traditional extensive farming systems in

the river floodplains. Farmers stimulated inundation and sedimentation for their grassland production, conditions that are essential for meadows belonging to the *Alopecurion pratensis*, to which the different types of *Fritillaria* stands belong. The disappearance of these agricultural systems has led to a strong decline of *Fritillaria* in Northwestern Europe. The remaining populations are threatened because of the decrease of the level in nutrient status, especially in systems where inundation and sedimentation belong to the past.

GARCIA NOVO, FRANCISCO, FERNANDEZ LO FASO, RAQUEL & GARCIA SEVILLA, DANIEL

Dept. of Plant Biology and Ecology, University of Seville, Spain.

Historical Ecology as a framework for ecological restoration projects in Doñana Natural Park (SW Spain).

In the Mediterranean Basin, several natural landscape traits point to ancient human interventions such as the creation of savannah pasture lands, the bare rocky surfaces in ranges or the intricate patterns of vegetation that develop on hilly areas as a response to abandoned terraces, channels and dwellings. Ecological restoration projects often try to reconstruct former plant communities by focusing on mature vegetation relics of the region or the theoretical description of primeval communities. We advocate a wider use of Historical Ecology to identify the previous stages of vegetation communities, in order to interpret the past formations and the processes driving the changes. This provides a temporal scale to the mosaic of vegetation patches, the extent of human intervention and the transitions among vegetation stages. The restoration of Doñana Natural Park will be described with the inclusion of the historic approach. Historical Ecology studies combine vegetation survey, soil and substrate analysis, pollen data and documentary evidence, available since 1295. The main trends of vegetation change and the species composition of previous communities were identified, providing a range of objectives for the restoration including lost species, communities in various degrees of succession (structure, composition, diversity) and human introduced elements or patterns.

GREULICH, SABINE¹, EL ABIDA, HAMZA¹ & KATER, EMIEL²

1. UMR CNRS 6173 CITERES, Laboratory “cities, societies, territories” (VST), group “dynamics of environment and landscapes”, University François Rabelais, Tours, France. 2. Centre for Sustainable Management

of Resources (CSMR), Faculty of Science, Radboud University, Nijmegen, The Netherlands.

Alluvial forest on riverine islands in the middle Loire River (France): how fast is succession proceeding?

The Loire is one of the few great rivers in Western Europe that has not been regulated, and which is subjected to river dynamics in a relatively wide floodplain area delimited by dikes. Due to riverbed incision and changed land use since the mid-1950s, the floodplain of the middle reaches of the Loire and its former river channels are increasingly colonized by woody vegetation. The present study investigates speed of succession from pioneer vegetation to hardwood forest on three islands. It therefore combines analysis of aerial photographs, field investigations on sample plots and dendrochronology. Progressive succession occurred on all three islands, starting, according to the island, from dominantly bare soil, herbaceous vegetation or open forest, and leading to a dominance of open or dense forest. A major rejuvenation event was observed in one of the islands. The time lag between different stages of succession differed significantly between sample plots, e.g. the time between the establishment of softwood pioneer species and hardwood species could be between six and 90 years. An analysis of inundation history, exposure to potentially high flow velocities during floods and integration of topographic elevation data will try to explain those differences.

JANSEN, FLORIAN

Geobotany & Nature Conservation, Institute of Botany and Landscape Ecology, Ernst-Moritz-Arndt-University, D-17487 Greifswald, Germany.

Gathering and evaluation of landscape changes – quantitative historical comparisons by vegetation ecology methods

Historical landscape ecology is often limited to verbal descriptions. The aim of the presented exploration is a semi-quantitative comparison of a northeast German landscape at 1700 AD with present-day conditions. The historical landscape is reconstructed with the help of the Swedish register cards of Vorpommer and their description books. Changes of the landscape are produced on the basis of vegetation ecological landscape factors like moisture, trophic and acidity classes as well as the degree of disturbance and others. In order to judge the measure of anthropogenic influence, reconstructed natural conditions (how the landscape would have developed without intervention of man) are derived and a scale of cultural influence is developed. The analyses reveal big differences

between the landscape of 1700 and today. The ‘nature proximity’ of the year 1697 shows an average sum of deviations to the natural state of $N = 4$ (‘close to nature’). Today’s landscape has, despite a purely agrarian village structure, an average degree of ‘culturalness’ of $N = 8$ (‘nature distant’). Moreover, it shows a much sharper contrast between areas of ‘close to nature’ (timber forests, sedge reeds) and intensively changed areas than the historical landscape with its smooth transitions.

MARAGE¹, DAMIEN, GARRAUD², LUC & RAMEAU¹ JEAN-CLAUDE

1 ENGREF, LERFoB UMR INRA-ENGREF 1092, Ecologie forestière, 14 rue Girardet, CS 4216, 54 042 Nancy cedex, France; 2 Conservatoire Botanique National Alpin de Gap-Charance, Domaine de Charance, 05 000 Gap, France.

The importance of land-use history and environmental variables for the understanding of the ecology of threatened endemic species such as *Eryngium spinalba*

The spatial prediction of plant population dynamics is essential for much conservation management. This is especially true for threatened endemic species, of which we know what determines their distribution is a necessary precursor for schemes to mitigate decline or threat. In our study, we assumed that endemic species distribution should be correctly predicted through environmental variables, but also taking into account anthropogenic, geo-referenced variables. Potential distribution area and abundance classes of *Eryngium spinalba* Vill. (Apiaceae) were predicted, with logistic regression and ordinal logistic regression respectively, in a watershed listed in the Natura 2000 European network. Aspect, global solar radiation for March, elevation and grazing pressure are the main variables dictating its presence probability (adjusted- $D^2 = 0.25$ and Area Under the Curve = 0.85). Taking into account the persistence of agro-pastoral activities, diachronic analysis (Napoleonic cadastral map and orthorectified photographs) improved the assessment of model prediction (adjusted- $D^2 = 0.42$ and Area Under the Curve = 0.92) and the level of spatial concordance with independent surveys. We reached a better ecological understanding of this threatened species, which, in the context of land abandonment, is diminishing as a result of the decline of its favoured habitats, and revealed the key role of pastoral activities and historic continuity in its distribution and persistence.

MUNZBERGOVA, ZUZANA

Institute of Botany, Academy of Sciences of the Czech Republic, Pruhonice, Czech Republic

Historical landscape connectivity affects patterns of genetic diversity in a grassland species

Many studies explore the effect of present and past landscape structure on species distribution and diversity. We know little about their effect on genetic diversity and structure of the populations and about correspondence of the effects on genetic patterns and other population properties. We studied relationships between present and past landscape structure, patterns of genetic diversity, population sizes and landscape level distribution in a perennial grassland herb. We collected data on genetic composition of 30 populations, on their size, proportional flowering and on occupancy of all suitable habitats. The results indicate that both current and past landscape have an effect on genetic properties of the populations as well as on population properties and habitat occupancy. There is little agreement between patterns identified at the different levels, suggesting that the effects identified at one level cannot be easily transferred to the other level. Our results suggest that habitat age and past connectivity may be important determinants of genetic patterns within populations and that landscape history may significantly contribute to our understanding of distribution of genetic diversity within species. Such knowledge maybe of help in deciding which populations should get priority in conservation if decisions are to be made.

PEZZI, GIOVANNA

Department of Evolutionary Experimental Biology, Bologna University, Italy.

Landscape and old chestnut wood temporal patterns in a Site of Community Importance in the Northern Apennines, Italy

Chestnut woods still play an important role in southern Europe. Like other human-related landscapes, chestnut woods have undergone a number of changes. A survey of the changes which have occurred over the past two centuries was conducted at a Site of Community Importance (SCI), Mt. Vigese (IT4050013). The temporal pattern over the past two centuries was described with the aid of old cadastral maps and aerial photographs in a GIS environment. Chestnut orchards were prevalent up to the 1950s. Afterwards, distinct changes in their management took place. Today, chestnut woods are mainly coppices derived from the

felling of orchards. At the sites covered by chestnut orchards in the 19th century, the spatial pattern of woody species was analyzed on plots selected using a probabilistic approach. Three dominant woody species were identified: *Castanea sativa* is still dominant in the majority of plots, while *Ostrya carpinifolia* and *Fagus sylvatica* dominate both abandoned orchards and old coppices at the lowest and highest altitudes, respectively. Such vegetation changes derive mainly from a decrease in the area's population, which has led to changes in the management of mountain resources. Main trends in vegetation and species diversity are briefly discussed.

ROTHERHAM, IAN D.

Sheffield Hallam University, Sheffield, UK.

Cultural Severance – Causes and Consequences

The extent of traditional and 'cultural' use of natural resources and their consequent impacts on landscape and ecology are often overlooked. Even major landscape-scale effects, such as the formation of the Norfolk Broads by medieval peat-cutting to supply Norwich and other areas with fuel, are often overlooked, and features are deemed to be 'natural'. Rotherham *et al.* (1997, 1998, 2004) described effects of medieval and later peat-cutting on British upland landscapes which had previously been overlooked. Similarly, whilst ancient woodlands are amongst Britain's most highly-valued conservation sites, their management as coppice for fuel-wood and charcoal are often misunderstood. The drivers of change and the factors that determine contemporary ecology are frequently ignored. It is increasingly recognised that medieval woods, heaths, commons, and bogs across western and Mediterranean Europe supplied most people with fuel, building materials and food over many centuries. With the provision of energy for domestic use, medieval coppice woods and peatland turbaries fuelled much early industry too. Different fuels (mineral coal, wood, charcoal, and peat or turf), had varying impacts and yet their landscapes and economics are rarely considered. Early accounts note conflicts over resource use. They describe for example, medieval iron masters supposedly destroying woods and competing with other users for possession; but to the untutored eye 'sustainable' coppice management does look devastated. Similarly re-grown high forest seems pristine and almost primeval, 'ancient' woodland; but both views are mistaken. Understanding the implication of different land-uses and the both drastic and subtle impacts on soils, on water, and on vegetation are

important in informing future management. Many sites are now managed in ignorance of former cultural uses, and of the implications of their severance. This approach is not conducive to sustainable ecosystems.

SHIMODA, MICHIKO¹ & ABE, HIDEKI²

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Changes of landscapes and vegetation recorded in historical materials found in Kurose Town, western Japan

We have been involved with a compilation project to document the history of Kurose Town, western Japan. Since 1999 we have collected historical materials and also conducted field research on the plants and vegetation. Among the many materials of the Edo Era (1603-1867), we found maps which depicted the mountains and villages realistically, and documents which recorded land use, flora, fauna and crops. In the maps painted early in the 19th century, mountains were covered with pine forest or were bare. Documents of that time show that mountains consisted of woodlands protected by local government, woodlands for timber and firewood, and grasslands for pasture manure. Village people exploited plants from mountains. Subsequent maps, documents and photographs show that the landscape of Kurose was relatively unchanged from the condition of the 19th century until the 1950s. In the 1960s, lifestyles of farmers and agricultural practices changed dramatically. People began to use electricity, propane and chemical fertilizer instead of charcoal, firewood and manure. Recent air photographs show that bare lands of the mountains continued to decrease and most of the mountains became covered with trees. Historical materials show that the landscape and vegetation have been closely related to lifestyles and agricultural techniques.

SPADA, FRANCESCO, AGRILLO, EMILIANO, CASELLA, LAURA, ISOPI, RAFFAELLA & PASSIGLI, SUSANNA

Department of Plant Biology, University of La Sapienza, Rome, Italy.

A long history of changes in land use: the origin of the present day landscape in the Roman Campagna

Many historical records are available for the area where the city of Roma was founded. Nevertheless little attention has been paid to the history of the plant cover in the area since the beginning of the first

settlements, due to the prevalence of the cultural tradition in the study of the origins of the Roman world. Large forests were reported by the scholars, but the pictorial tradition of the Grand Tour shows a completely treeless undulating landscape, covered by what were apparently the anthropogenic grasslands of a long history of pastoralism, which lasted up to the middle of the last century. The development and patterns of this major deforestation are reviewed in the framework of the peculiar phytogeography of this area.

WILL-WOLF, SUSAN¹, TREST, MARIE T.¹, HAWBAKER, TODD², RADELOFF, VOLKER², NELSEN, MATTHEW, P¹., REIS, ANNE¹ & MAKHOLM, MARTHA³.

1Department of Botany, 317 Birge Hall, University of Wisconsin, 430 Lincoln Drive, Madison, WI 53706-1381 USA. 2 Department of Forest Ecology and Management, 119 Russell Laboratories, University of Wisconsin-Madison, USA 53706. 3 Wisconsin Department of Natural Resources, Madison, Wisconsin, USA.

Forest lichens and trees: 30-year effects of anthropogenic landscape pattern

We found, in a 3-decade study in upper midwest USA, that lichens and other forest community variables correlated more with a land use/disturbance gradient than with local pollution. Response variables reflect tree species composition, lichen species composition, and lichen tissue element content. This geographic gradient is independent of known pollution gradients and of a site moisture gradient also linked to understory shade. NMS ordination axes correlated with the land use gradient expressed increasing proportion of variation 1974-2003. In 2003, lichen species richness was higher and proportion of disturbance-tolerant lichen species was lower when there is higher % forest around a site (smaller spatial scale). Disturbance-tolerant tree species and exotic shrubs increased more at eastern, more disturbed sites, while later-successional tree species increased more at western, less disturbed sites with more forest in the area (at larger but not smaller spatial scale). Our results suggest both lichens and trees respond to effects of land use on species dispersal and/or establishment, but effects operate at different temporal and spatial scales in this landscape. 2003 lichen tissue sulfur content at woods edges was higher with higher lichen species richness, higher % forest and lower % agricultural land use (partial correlations accounting for local pollution source).

**WOJTERSKA, MARIA¹, RATYŃSKA, HALINA²,
RĄCZKOWSKI, WŁODZIMIERZ³**

1 Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań, Poland. 2 Department of Botany, Kazimierz Wielki University, Bydgoszcz, Poland. 3 Department of Prehistory, Adam Mickiewicz University, Poznań, Poland.

Vegetation of rural settlements in Western Poland versus their spatial structure and history

The study focuses on over 30 rural settlements of medieval origin (13th – 15th century) situated in the westernmost part of the country. The spatial structure of villages, representing two distinct types: linear and oval shape, and their actual vegetation were studied in a landscape context, taking into account: the type of potential natural vegetation in the surroundings and the degree of transformation the village underwent in the last century. The contemporary landscape structure was compared to historical data (maps and aerial photographs). Research into vegetation structure covered: number of plant communities, spectrum of their syngeneses and of formation types. The vegetation of villages and their surroundings was mapped. In the studies several landscape metrics were analysed such as: number and size of patches and number of their types, nearest neighbour statistics and proximity index, diversity of communities within complex of plant communities (settlement versus surrounding fields).

Poster presentations -

Nygaard, Betina

Department of Wildlife Biology and Biodiversity, National Environmental Research Institute, University of Aarhus, Denmark

Classification of habitat types in Danish wetlands

“Since 2004 a nation-wide monitoring programme assessing the conservation status of habitat types listed for protection in the EC Habitat Directive, has been carried out in Denmark. The present study is based on the species composition in wetland plots ranging from raised bogs to stream borders and rich fens from the first years of monitoring. Data has been subjected to various multivariate statistics in order to define the floristic and ecological boundaries of the protected habitat types and to characterize their variability and present biological status”.

RuauX, Brigitte¹, Greulich, Sabine¹, Haury, Jacques² & Berton, Jean-Pierre¹.

1. Équipe VST- Dynamiques Environnementales et Paysagères, UMR CNRS 6173 CITERES-Université F. Rabelais, Tours, 2. UMR INRA-Agrocampus 985 Ecobiologie et Qualité des Hydrosystèmes Continentaux, Rennes, France.

Fruit buoyancy and effect of temperature on seed viability of the two alien invasive *Ludwigia* (Onagraceae) species on the middle Loire River (France).

Ludwigia peploides ssp. *montevidensis* and *L. grandiflora* ssp. *hexapetala*, are expanding their geographic range due to clonal production; they are considered to be the aquatic plants causing the most important nuisances in French river habitats. During the 1970s, they colonized former channels of the middle Loire River, previously scarcely covered by aquatic vegetation. Now, the neophytic *Ludwigia* builds up dense and continuous stands, with potentially high impact on biodiversity and sedimentation rates. This study investigates the potential for sexual reproduction in the context of the degraded oceanic climate of the middle Loire River, as an alternative to vegetative multiplication. We studied 14 populations (9 for *L. peploides* and 5 for *L. grandiflora*, with 90 fruits for each of them). Both species produced high numbers of fruits. Time of buoyancy was significantly longer in *L. grandiflora* than in *L. peploides*, while viability was higher in *L. peploides* than in *L. grandiflora* ($77 \pm 23\%$ vs $47 \pm 28\%$). Low temperatures (0°C), comparable to winter conditions for the middle Loire River, had no impact on viability rates. Only freezing reduced the viability of seeds in both species by about 50%. Consequently, sexual reproduction could become an additional mechanism for winter survival and spread of *Ludwigia*, especially over long distances.

What factors determine grassland diversity?

BRUUN, HANS HENRIK

Department of Ecology, Section of Plant Ecology and Systematics, Lund University, Ecology Building, 223 62 Lund, Sweden.

A seedlings-eye view on diversity in temperate grasslands

Temperate grasslands are very species-rich ecosystems, at least at fine scales. Local diversity is the result of an equation with two elements: enrichment from the regional species pool by colonisation and impoverishment through local extinction. While much research has focused on local processes responsible for extinction and on the balance between local and regional forces, little effort has been made to identify the determinants of the size of regional species pools for grasslands and other vegetation types. I start from a theoretical model for the build-up of species pools over time. This model takes a seedlings-eye view of the world. It focuses on speciation rate, community dynamism and feed-back from the local environment to the species pool build-up rate, but also includes metacommunity size through time and space. I then discuss the model in relation to temperate grasslands and present recent evidence for a number of factors influencing or correlating with species pool size and build-up rate, from macroevolution, large-scale migration, glacial survival and history of human land-use down to community invasibility, recruitment patterns, genetic diversity and age structure in populations making up communities. I will have a species focus on the diversity-productivity relationship.

COUSINS, A.O. SARA

Department of Botany, Stockholm University, Sweden.

When is the historical landscape important?

The long tradition of grassland management has accumulated an exceptionally high plant species-richness in semi-natural grasslands. In the past, grasslands covered extensive areas in rural landscapes but have declined dramatically during the last century. Recently, several studies have pinpointed the need to analyse past landscape patterns to understand fragmentation effects on plant diversity, as no correlations have been found with present landscape patterns. An explanation is that the slow response of long-lived plants to environmental change has created an extinction debt. However, the response (or lack thereof) to historical spatial pattern seems to depend on the type of landscape. I have analysed historical and contemporary patterns in both traditional and production landscapes. Maps from the 18th century and 1901, aerial photograph interpretations from 1940s and the present were used, and plant species-richness was investigated. I found that past landscape pattern mattered in landscapes with a fair amount of grassland left, whereas present habitat size as well as management was more important for species diversity in

production landscapes with little grassland left. Landscape history is not directly important for present-day plant diversity patterns in production landscapes, although past grassland management is a prerequisite for the species-richness that can be found there today.

DENGLER, JÜRGEN, BOCH, STEFFEN, DOLNIK, CHRISTIAN, JESCHKE, MICHAEL, KIEHL, KATHRIN & LÖBEL, SWANTJE

Institute of Ecology & Environmental Chemistry, Lüneberg University, Germany.

Comparative analysis of species-area relationships in European dry grasslands – across regions, taxa, and scales

The increase of species richness with the enlargement of the size of the analysed area is one of the most fundamental ‘laws’ in ecology. However, little is known about the variability of SAR function types and their parameters and how they depend on scale, taxon, vegetation structure, and environmental factors. We studied different dry grassland types (Koelerio-Corynephoronea, Sedo-Scleranthenea, Festuco-Brometea) in various regions of central and northern Europe (Germany, Switzerland, Sweden, Russia, Estonia), analysing altogether more than 200 series of nested-plots. All vascular plants, bryophytes, and lichens (mostly also including non-terricolous taxa) were recorded on plot sizes ranging from 1 mm² to 900 m². With an average of 53.6 and a maximum of 80 species on 4 m², the *Gypsophilo fastigiatae-Globularietum vulgaris* (Sedo-Scleranthenea) from the Swedish island of Öland showed the highest species densities on small scales from all the studied communities. We found that within the analysed range, the SAR is generally best described by a power function ($S = c A^z$), whereas exponential functions only rarely and saturation functions never yielded a better fit. The increments of the power functions (z) mostly fall into a range between 0.19 and 0.23 and show only a very low scale-dependency within individual curves. Further, we will present analyses on the dependency of SAR parameters on taxon (vascular plants, bryophytes, lichens), geographic position, environmental conditions, and land-use history.

EJRNAES, RASMUS

Department of Wildlife Ecology and Biodiversity, National Environmental Research Institute, University of Aarhus, Grenåvej, 128410 Rønne, Denmark.

Diversity effects of environment and species arrival in a synthesised grassland succession

In this study, we investigated the combined effects of environmental controls and arrival order for the outcome of a synthesised grassland succession. Using a grassland microcosm as a model system, we manipulated fertility, disturbance by defoliation, soil/microclimate, and arrival order of species belonging to two groups differing in functional attributes. We analyzed the outcome of community assembly dynamics in terms of species richness, invasibility, and species composition. The analyses revealed strong environmental control over species richness and invasibility. Species composition on the other hand was mainly determined by the arrival order of species. The importance of arrival order for composition offers an explanation of the difficulties in predicting local occurrences of species in the field. In our experiment, variation in fertility and disturbance was controlling colonization and thus species richness. The key mechanism is suggested to be asymmetric competition, and our results show that this mechanism is relatively insensitive to the species through which it works. While our analyses indicate a positive and significant correlation between species richness and invasibility, the significance disappears after accounting for the effect of the environment.

FERGUS, A.J., PETERMANN, J., TURNBULL, L. A. & SCHMID, B.

Institute of Environmental Science, University of Zürich, Switzerland.

Negative soil feedbacks and the assembly and stability of functionally diverse grasslands

Crop rotation can have an enormous impact on agricultural productivity, often due to the avoidance of negative soil feedbacks caused by pest/pathogen build-ups. However, ecologists have been slow to recognise what farmers have apparently long known. Here, we consider how general negative soil feedbacks might be in grasslands. Taking a functional group approach, using forbs, grasses and legumes, we asked how easily a community could be “invaded” by a resident functional group (“home”), versus a non-resident functional group (“away”). We added seeds from both home and away functional groups to long-term monoculture plots of 48 species. Invaders from non-resident functional groups were generally more successful; this was consistent for most grasses and legumes, and half of the forbs. We then investigated potential

causes of this effect. We transferred soil from 24 monocultures to the greenhouse, and re-grew species on both home and away soils, with four soil treatments and a control. Species again produced less biomass (up to 90% less) when re-grown on home soils than when grown on away soils. Treatments (gamma radiation) revealed that poor performance on home soils was caused by a build-up of functional group-specific pathogens in monoculture soils. Basic modelling indicated that measured effect sizes were sufficient to stabilise community dynamics. The generality and strength of this negative feedback suggests that it has been an overlooked mechanism of coexistence, and explains at least some of the functional diversity evident in grasslands.

HERBEN, TOMÁŠ

Institute of Botany, Academy of Sciences of the Czech Republic, CZ-252 43 Průhonice, Czech Republic and Department of Botany, Faculty of Science, Charles University, Benátská 2, CZ-128 01 Praha 2, Czech Republic.

Testing hypotheses on interactions in a grassland community using a spatially explicit model of clonal plant growth

Grasslands are spatially complex communities with predominant clonal growth and limited, albeit existing, seedling recruitment, typically maintained by mowing or grazing. While experiments with the whole community have been commonplace in ecology, within-community processes have been much more difficult to study due to the fine scale of the interactions involved. Therefore we know very little for example on the role of seedling recruitment and/or the role of clonal growth parameters on dynamics of grassland communities. To address these issues, I parameterized a highly calibrated, spatially explicit, individual-based model of clonal plant population dynamics for four major species in a mountain grassland for which long-term observational and experimental data are available. This model includes traits describing growth, resource allocation, and response to competition, as well as architectural traits that determine spatial spread. For most of the parameters I was able to get estimates from field and/or garden measurements; the remaining parameters were estimated by fitting the model to a small subset of data. The model was verified with data collected in fine-scale experiments. I am using the model (i) to determine the long term dynamic role of seedling recruitment, and (ii) to examine the role of clonal growth traits of the component species.

HOVI, ANTTI

Palmenia Centre for Continuing Education, University of Helsinki, Finland.

Diversity of semi-natural short-herb grasslands in southern Finland

The basic aims were to study the formation and diversity of species-rich semi-natural grasslands and their connection to environmental factors. 27 grasslands in southern Finland were studied as representatives of short-herb grasslands. CCA was used to study connections to 17 environmental factors. Species richness and Shannon-Wiener diversity indexes were determined. Soil analyses of 11 nutrients were compared to Ellenberg environmental indicator values of vegetation. The stage of succession, amount of nutrients and grazing history proved to be the most important environmental factors determining grassland diversity. Settlement history was another factor related to diversity. The highest species richness was connected to the *Nardus stricta* (mat grass) type of grasslands which are relatively low in production. On the other hand, the higher producing semi-natural grasslands, *Dactylis glomerata* - *Knautia arvensis* type, had higher amounts of species connected to old settlement. The short herb grasslands had, on average, 24 species/ 4 m² (12-41) and best grasslands had 25-36 species/ 1 m². Species richness was found to be a more reliable indicator for valuable grasslands than diversity indicated by the Shannon-Wiener diversity index.

OPIK, MAARJA

Scottish Crop Research Institute, Dundee, DD2 5DA, UK.

Diversity of arbuscular mycorrhizal fungi in grasslands and forests - a determinant of plant diversity?

How does diversity of mycorrhizal fungi affect that of plants and vice versa? To tackle these questions, results from original case studies and a meta-analysis will be presented regarding the diversity of arbuscular mycorrhizal (AM) fungi and its links with plant diversity. Earlier experiments suggest that increased richness of AM fungi may increase or decrease plant community diversity. A pot experiment indicated that the composition of AM fungal communities may have a pronounced effect on individual plant growth, thus potentially affecting the plant diversity. Also, the 'better' fungal community originated from a location with higher plant richness. Community level links between plants and AM fungi will be discussed, mainly based on data from a fine-scale spatio-temporal

survey conducted in an Estonian herb-rich forest, including the effects of abiotic parameters and disturbance regime. At a global scale, distinct richness and diversity patterns of AM fungal communities were identified in biomes such as tropical forests, temperate forests and disturbed habitats whilst the grasslands exhibited larger variation in terms of fungal community composition. In conclusion, the most crucial gaps in our understanding of the interactions between plant and mycorrhizal fungal diversity will be drawn.

PÄRTEL, MEELIS, HELM, AVELIINA, REITALU, TRIIN, LIIRA, JAAN & ZOBEL, MARTIN

University of Tartu, Lai 40, Tartu 51005, Estonia.

Grassland diversity related to historic and current human population density

Species-rich semi-natural grasslands in Europe developed during prehistoric times and have endured due to human activity. At the same time, intensive grassland management or changes in land use may result in species extinction. As a consequence, plant diversity in semi-natural calcareous grasslands may be related to both historic and current human population density. We were able to demonstrate for the first time that current vascular plant diversity in semi-natural calcareous grasslands is positively correlated to human settlement density as far back as 1000 years ago. This can be explained by enhancement of the extent of grassland and species dispersal by prehistoric humans. In contrast, small-scale species richness in grasslands was the highest in the intermediate current human population densities, indicative of moderate land use intensity. Low current human population means lack of management, high current human population density has led to habitat loss and deterioration. Consequently, human land-use legacy from prehistoric times is an important aspect in plant ecology, which could be an important contributor to the current variation in biodiversity. In addition, current human influence of intermediate intensity is needed for dense "packing" of grassland plant species within a limited space.

VIARD-CRETAT, FLORE & LAVOREL, SANDRA

Laboratoire 39; Ecologie Alpine, CNRS, Grenoble, France.

Plant regeneration strategies through land use change in subalpine grasslands

Plant community dynamics is important especially in changing landscapes. In subalpine zones, agriculture is maintaining plant diversity through extensive practices such as mowing. These zones are often abandoned nowadays, leading to important changes in terms of diversity. Different recruitment strategies between species could in part be the origin of these changing compositions since disturbance level is known to select species from their dynamics. Plant traits are suitable to emphasize strategies of biomass allocation used by the plant and can also be used to study regenerative processes. In a field experiment, we compared seed aggregated traits between a community still being mowed and an abandoned one. Manipulating mowing, we tested the short term effect of abandonment of mowing on seed traits. Another consequence of abandonment is the appearance of a thick layer of litter on the soil. Litter accumulation as well as the cessation of cutting may have different consequences in terms of resource availability and storage in the plant. The experiment was thus designed to disentangle the effect on recruitment of short term mowing, litter removal by mowing, and long term effect. Seed mass and seed number were used as markers on the whole community. We thus expect to be able to understand fine regeneration processes and predict outcomes of abandonment.

ZOBEL, KRISTJAN

Institute of Botany and Ecology, University of Tartu, Lai St.40, Tartu 51005, Estonia.

Circumstantial evidence about community saturation with species in a species-rich grassland

Although a lot of evidence has accumulated supporting the neutral or quasi-neutral view on plant community diversity, the classical understanding that communities can be saturated with species has not yet been conclusively refuted. I present evidence from a five-year permanent plot study in a species-rich calcareous wooded meadow showing that the normally neutral (random) turnover of species in 40 x 40 cm plots can be changed into competition-driven process by cessation of annual mowing of the grassland. This can be seen in a strong positive relationship between species richness in a plot and the number of species becoming extinct in the plot during one season (significance assessed by statistical modelling). The meaning and significance of this and other results of the permanent plot study for the diversity theory will be discussed.

Poster presentations –

Janišová, Monika

Institute of Botany, Dúbravská Cesta 14, SK-94523 Bratislava, Slovak Republic

Factors affecting beta-diversity of semi-natural grasslands

“Between-habitat diversity (beta-diversity) of semi-natural grassland communities was investigated on a large dataset of phytosociological relevés. The sampling covered the whole area of Slovakia including both lowland and mountain areas and contained 8296 relevés from 1924 onwards. The effects of five environmental factors were studied: altitude, temperature, moisture, nutrients and soil reaction. The last four variables were calculated as unweighted averages of Ellenberg indicator numbers for species in individual relevés. Altitude was measured in the field or compiled from regional maps. Presence-absence data were used for calculation of the Whittaker index which was used as a measure of difference between local assemblages at individual factor levels. Beta-diversity permanently increased along both temperature and pH gradients and was higher at lower altitudes than at higher altitudes in the mountains. The effects of both moisture and nutrients were similar: habitat at intermediate factor levels had the lowest beta-diversity, while it increased towards both lower and higher factor levels. This research was supported by grants APVT-51-015804 and VEGA”.

Kuiters A.T.¹, Huiskes H.P.J.^{1*}, Ozinga W.A.¹² & Schaminée J.H.J.¹²

¹ Alterra Wageningen UR / ² Radboud University, Nijmegen, the Netherlands.

Endozoochorous seed dispersal by sheep in limestone grasslands in South Limburg, the Netherlands

Endozoochorous seed dispersal by sheep was investigated at six calcareous grassland sites in the Province of Limburg, the Netherlands.

The aim of this study was to investigate the potential of long-distance seed dispersal by sheep. Seed dispersal can be an important bottleneck in the regeneration of calcareous grasslands. Grazing is the most common management measure in South Limburgian limestone grasslands, where sheep flocks are periodically moved between the sites. From 2005 to 2007, a total of 35 freshly deposited sheep dung samples were collected between May and October. The number of viable seeds was determined

by germination under greenhouse conditions. Although large differences were found among sites, mean density amounted to 0.4 seeds per g dry wt. About 55 plant species were found germinating from sheep dung, about 30% of them characteristic for limestone grasslands. Small-seeded species (seed mass <2 mg) were most abundant. Trivial species such as *Urtica dioica* dominated dung samples collected in September (5.0-6.0 seeds per mg dry wt). In conclusion, sheep flocks may act as effective dispersers of plant species in limestone grasslands. Dispersal of plant species from species-rich grasslands to less developed sites under restoration can be strongly improved by applying well-planned rotation schemes for sheep grazing.

Skodova, Iveta

Institute of Botany, Slovak Academy of Sciences, Slovak Republic
Diversity of grasslands in the Biele Krapaty Mts. (Slovak Republic)

The meso- and subxerophilous grasslands of the Biele Karpaty Mts. are famous for their great species richness. About 80 species of vascular plants may occur in a plot of 25 m². Factors affecting species composition and diversity parameters of grasslands were studied with a set of 98 phytosociological relevés. Soil parameters (pH, content of CaCO₃, nitrogen, carbon and humus content) and a set of topographical (exposure, inclination, altitude, xericity) and biological variables (cover of both herb and moss layers, litter cover) as well as management features (grazing, mowing, abandonment) were recorded for each relevé. The main aim was to investigate the effect of these factors on both the species composition and diversity parameters. The relation between species composition and the measured factors was analysed by a canonical correspondence analysis (CCA). The relation between the factors and species diversity parameters (species richness, Shannon-Wiener index, equitability) was evaluated by correlation analysis. This research was supported by grants APVT-51-015804 and VEGA 2/5084/25.

Tsiripidis, I. & Papaioannou, A.

School of Biology, Aristotle University of Thessaloniki, Greece.

Investigation of the serpentine factor in a grassland vegetation type on Mt Vermio (north-central Greece)

The serpentine factor has been defined as the factor or the combination of factors related to the infertility of serpentine soils and the nature of the

vegetation colonizing them. This work aims at the exploration of the major soil factors that determine the floristic composition in a grassland vegetation type occurring on serpentine soils on Mt Vermio (north-central Greece). In total 50 quadrats were subjectively chosen, so that the different main types of grassland vegetation can be properly represented. Species cover was estimated using the point-quadrat method, with a density of 100 pins/m². From each quadrat a composite soil sample was taken representing the upper 10 cm of the topsoil (organic layers were excluded). The following soil parameters were measured: acidity, organic matter and nitrogen content, particle size distribution and the exchangeable elemental concentration of phosphorus, copper, zinc, iron, manganese, nickel, potassium, magnesium, calcium and sodium. Vegetation and soil data were analysed by means of multivariate methods in order to estimate the floristic variation that is accounted for by the measured environmental variables.

Viard-Cretat, Flore, Gallet, Christiane & Lavorel, Sandra
Laboratory of Alpine Ecology, CNRS, Grenoble, France.

Does mowing increase allelopathic effects of dominants on recruitment in subalpine grasslands?

Although allelopathy is a well-known process structuring dominance and abundance in plant communities, it remains often impossible to prove its existence. We developed a new method to investigate its role in the dominance of the grass *Festuca paniculata* in subalpine grasslands. This species becomes very dominant when mowing is abandoned and was suspected to prevent the regeneration of other species through the release of phenolic compounds in its environment. We used mesocosms of *F. paniculata* irrigating mesocosms of target seedlings with or without activated carbon, including a cutting treatment to mimic mowing. The recruitment phase of three species including *F. paniculata* was studied. This design was completed with chemical analyses to quantify and identify allelopathic compounds. All the species except *F. paniculata* showed a decrease of their growth after one season when *F. paniculata* was present. They allocated more resources to leaves than to roots. This effect was not due to resource modifications. The activated carbon did not counterbalance the negative effect of *F. paniculata* but had its proper effect on the growth of the seedlings. Finally, mowing slightly increased the negative effect of *F. paniculata* on seedling growth. The method

seems thus to be appropriate but the role of activated carbon needs to be clarified.

Plant-animal interactions, especially grazing

ALLAN, E. & CRAWLEY, M.J.

Silwood Park, Imperial College, Ascot, UK.

Herbivore interactions and grassland biodiversity

Herbivory by vertebrates has been shown to be a major force structuring plant communities and promoting coexistence. The role and importance of invertebrate herbivores and specialist herbivores is far less clear because very few studies have involved long-term exclusions of them. We present data from an experiment carried out in grassland in Silwood Park, southern England, where insects and molluscs have been excluded, in factorial combinations, for 16 years. A specialist insect plays a keystone role in maintaining diversity in the grassland by feeding preferentially on a dominant grass, *Holcus mollis*, therefore reducing its dominance and allowing the coexistence of other grasses and of forbs. Molluscs, however, balance this effect by selectively eliminating seedlings of forbs thereby reducing diversity. The two groups therefore have compensatory effects on diversity through different mechanisms: insects by mediating competition and molluscs by increasing mortality of forbs. The effects of these groups are striking, with percentage cover of forbs twice as high in plots with insects but no molluscs as in plots with molluscs but no insects, but the mollusc effects in particular took many years to appear and would have been missed in studies of shorter duration.

BRUELHEIDE, HELGE, BREMERICH, VANESSA & BÜTOF, ASTRID

Institute of Biology / Geobotany and Botanical Garden, Martin Luther University Halle Wittenberg, Germany.

Do detrimental biotic interactions limit the geographical range of continental species?

It is commonly accepted that climatic factors determine the shape and limits of geographical ranges of plant species. However, climate provides only inadequate explanations for range boundaries when the climatic conditions improve outside a species' range. In Europe, this is particularly the case for the western distribution boundary of continental species. While most continental species thrive in culture, they fail to become established and sustain viable populations in nature. We asked whether increasing herbivory or pathogen levels along a continentality-oceanicity gradient might contribute to this failure. Comparing congeneric plant species with contrasting range types, we hypothesised that continental species are more affected by herbivores or pathogens than their widespread or oceanically-distributed congeners. Laboratory food choice experiments with 13 species pairs and with *Arion lusitanicus* and *Helix pomatia* as herbivores did not support the hypothesis of superior palatability of continental species, with the exception of only one genus (*Gypsophila*). Similarly, we did not encounter differences in consumed leaf mass in long-term field mollusc enclosure experiments. Unexpectedly, we encountered a mouse population explosion in the second project year, which resulted in herbivory effects by mice. Out of six species pairs, there were three cases where damage by mice was higher in the continental species (*Centaurea*, *Koeleria*, *Silene*). Growing the plants in the presence of the soil-borne root pathogen *Pythium ultimum* turned out to inflict more damage upon the continental species in two out of five species pairs (*Dianthus*, *Scabiosa*). As we found no consistent significant effects for a particular herbivore or pathogen across all tested different genera, we have to reject the hypothesis of a common biotic explanation of the range limit of continental species. We conclude that western range limits of continental species have idiosyncratic causes. Nevertheless, biotic interactions clearly mattered, with an emerging pattern of different biotic causes for range limits within different genera.

EICHBERG, C., SUESS, K., STORM, C. & SCHWABE, A.

Institute of Botany, Vegetation Ecology, Darmstadt University of Technology, Germany.

Sheep grazing in nutrient-poor sand grassland: is there a solution to combine preservation of site-typical plant diversity and adequate livestock nutrition?

There is growing evidence that sheep grazing is an adequate management tool to preserve the specific phytodiversity of threatened inland sand

grassland. In nutrient-poor ecosystems, however, livestock nutrition often is physiologically and economically critical. To elucidate the relationships between plant diversity, productivity (above-ground phytomass) and nutritional value in grasslands grazed by roaming sheep flocks, we ran two field studies in central Germany. Study 1 was carried out along a vegetational gradient in a sand grassland reserve. Study 2 tested the prediction that a grazing regime alternating between nutrient-poor and nutrient-rich ecosystems (mainly former fens) will lead to improved nutrition of sheep. Productivity was measured by means of weighed above-ground phytomass and data on livestock diet and phytodiversity were obtained. Study 1 revealed an inversely proportional relationship between nature conservation value and livestock nutrition at a fine-grain scale: species richness and number of threatened species were negatively related to productivity while crude protein content and grazed phytomass were positively related to productivity. The results of study 2 show that the alternating grazing regime can improve animal nutrition suggesting that economic and nature conservation aims can be optimised in parallel (provided that a nutrient transfer from nutrient-rich to nutrient-poor systems is prevented).

GLAVES, PETER & GRAY, RAYMOND

Biodiversity and Landscape History Research Institute, Venture House,
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Coastal grazing marsh – Characterisation and conservation management

Grazing marsh, a type of lowland wetland grassland, is regarded as a conservation priority habitat in England and is listed amongst biodiversity action plan habitats. There has been a great deal of concern regarding the fragmentation and loss of this habitat, particularly in coastal areas, where it was historically of greatest extent. Government funding has been provided to conserve, enhance and restore this habitat.

Many key British ecological texts however do not include grazing marsh as a habitat type, and where grazing marsh is described and discussed there is inconsistency in how it is characterised. This raises the interesting question of how a habitat can be conserved or monitored when it has not been fully characterised.

Research was undertaken in the North Kent Marshes, one of the largest remaining areas of grazing marsh in England. Landscape and vegetation surveys were undertaken in all remaining grazing marsh fragments.

Sampling of the vegetation was carried out by means of a stratified random one meter square quadrats using a 'random walk procedure'; 778 quadrats were taken, each within a homogeneous stand. Species were recorded using the DAFOR scale. Phytosociological analysis was undertaken using twinspan, ordination and match to British National Vegetation Community types.

The results show that grazing contains a mosaic of habitat types, the dominant habitat being a lowland wetland grassland type, which is a variation on NVC communities MG6, MG7a/b and MG11, other vegetation communities being linked to topographic and hydrological variation. A grazing marsh grassland NVC community type has been proposed (MG7g) along with an ideal mosaic of community types.

Changes in management, particularly grazing and draining, and habitat fragmentation have effects on grazing vegetation communities, a vegetation change model has been proposed, this may be useful in management and conservation monitoring.

MANZANO, PABLO, AZCÁRATE, FRANCISCO M., MALO, JUAN E. & PECO, BEGOÑA

TEG, Dpto. Ecología, Universidad Autónoma de Madrid, Spain.

The importance of multi-level approaches to evaluate the effects of grazing in the Mediterranean.

Mediterranean systems are characterized by being subjected to periodical disturbances and by having a long ecological history of intense grazing, strongly related to human management. Abandonment of extensive management, linked to land-use changes in the last decades, has created the opportunity to evaluate the processes that drive plant biodiversity and plant functional traits in pastures. These questions were first approached by comparing a few contrasted sites or experimentally establishing grazing exclosures in heavily grazed sites, with results showing no clear effect of grazing on plant diversity at different scales but the selection of some plant traits such as seed size. The results obtained give a hint of underlying processes such as dispersal or perturbation. The development of GIS techniques has allowed the detailed measurement of fine-scaled grazed gradients and it has also provided detailed geographic information to control other variables that have proven to be influential, such as local climate or topography. The analysis of those fine-scaled data reveals more complex relationships, such as quadratic ones, that highlight the

interest of gradient analysis in pasture ecology. Moreover, the difficulty of observing some of those patterns at different scales points out the importance of multi-level approaches to ecological questions.

ROSENTHAL, GERT¹, SCHRAUTZER, JOACHIM² & EICHBERG, CARSTEN³

1 Institute of Landscape Planning and Ecology, University of Stuttgart, Germany. 2 Ecology Centre, University of Kiel, Germany. 3 Institute of Botany, Vegetation Ecology, Darmstadt University of Technology, Germany.

Extensive grazing and biodiversity – lessons learnt from recent grazing projects in Central Europe

Remnants of large grazing systems in climatically and/or edaphically disadvantaged (agriculturally marginal) areas comprise a high biodiversity in terms of plant species, vegetation structure and habitat type from the micro to the landscape scale. Therefore, extensive grazing by domestic herbivores is potentially an alternative management concept to traditional measures (e.g., mowing) for the realization of conservation and restoration targets, especially in former anthropo-zoogenic ecosystems. The presentation gives an overview on recent research projects which have been carried out in various types of open ecosystems in Central Europe. Important questions these projects were dealing with concern the role of different herbivore species, intra- and inter-area seed dispersal (epi-, endozoochorous), disturbance on various spatial and temporal scales, regression of vegetation succession (e.g., control of bush encroachment), impacts on population dynamics of target plant species and on landscape structure. Overall, the results give evidence that extensive grazing is a suitable tool for the conservation and recovery of many plant communities of open landscapes with a high site-typical biodiversity.

WESSELS, SASKIA

Institute of Botany, Vegetation Ecology, Darmstadt University of Technology, Darmstadt, Germany.

Effects of epizoochorous dispersal and trampling by large herbivores on plant establishment

Epizoochory can increase seed dispersal between isolated plant populations, but the post-dispersal fate is widely unknown. The contribution of sheep to the establishment of mainly threatened sand-

typical species was investigated. Soil conditions of three plots (81 sq.m. each) were improved by adding nutrient-poor seed-free sand (Northern upper Rhine valley, Germany). Seeds of 14 species were attached to the coats of sheep. Per plot, two animals were present for 24 h. Trampling patterns, seed shadow, and during an 8-month period seedling emergence and survival were recorded. Additionally, the potential effect of sheep trampling on seedling emergence and survival of *Jurinea cyanooides* and *Koeleria glauca* was studied. Despite varying retention half-times, different species showed fast seed detachment rates. Inter-specific emergence and establishment differences were recorded (high establishment, e.g. *Alyssum montanum* ssp. *gmelinii*, *Silene conica*). Spatial Analysis by Distance Indices (SADIE) showed patterns of trampling, seed shadow and seedling emergence to be non-randomly distributed in space. Next to significant associations between those patterns, correlations between sheep abundance, dispersed seeds and seedling numbers were found. On species level, the impact of trampling on seedling performance was variable; *J. cyanooides* was stimulated, whereas *K. glauca* showed no treatment effect.

Poster presentations –

Jauregui, J., Diaz Barradas, M.C., Zunzunegui, M.C., Ain-Lhout, F. & Alvarez, L.

Department of Ecology, University of Sevilla, Spain. Characterisation of *Argania spinosa* populations subjected to different environmental factors

Argania spinosa (Sapotaceae) is an endemic tree of Morocco, occupying semi-arid regions between Mediterranean vegetation and the desert. Its main distribution area is located in the southwest of the country and it is a UNESCO Human Heritage site. *Argania spinosa* can be considered a multi-usage tree. *Argania* woodlands protect the soil against erosion and desertification. The wood is used as fuel; the leaves are eaten by herbivores. The seeds are used to prepare an edible oil, appreciated by the local population. Due to the importance of this species and the lack of ecological studies, we were interested in carrying out a first characterization of *A. spinosa*. With this aim three contrasting populations were chosen, with different climate and management regimes. In each sampling area the coordinates of the estimated centre of every individual of *Argania* were recorded. Maximum canopy diameter, its perpendicular diameter and maximum tree height were also measured. Spatial distribution patterns were analysed using Ripley's K function. Leaf Area

Index and fruit production were quantified to have an estimate of plant productivity. The first results showed that plants mainly presented a random distribution. Significant morphological differences were not found between populations. Fruit production averaged 8 kg/tree/year”.

Verena Möllenbeck¹*, Thomas Fartmann¹ & Gabriel Hermann² Institute of Landscape Ecology, Department of Community Ecology, University of Münster, Robert-Koch-Str. 26, D-48149 Münster, Germany ²Arbeitsgruppe für Tierökologie und Planung, Johann-Strauß-Str. 22, D-70794 Filderstadt, Germany. Fire management in dry grasslands – a threat to the endangered butterfly *Hipparchia fagi*? Within the vineyards of the Kaiserstuhl area (south-west Germany) the slopes of vine terraces comprise a variety of habitats including dry and semi-dry grasslands of high nature conservation relevance. Formerly used for haymaking, these slopes suffer from invasion of woody species and perennial herbs today. To maintain an open meadow-vegetation structure, prescribed fire management in late winter has been re-introduced, which was assumed to pose a threat to species hibernating as larva. The Kaiserstuhl is the last remaining breeding area in Germany for the rare and highly endangered Woodland Grayling (*Hipparchia fagi*), a panto-mediterranean and xero-thermo-philous species, and represents the species’ northern range limit. Larval habitat preferences were analysed to assess the impact of winter burning on population viability. Beside microclimate, vegetation and host-plant structure were revealed to be the important parameters for larval habitat choice: Sparse vegetation coverage facilitates the warm microclimate and the distinct tuft-growth of the host plant *Bromus erectus* provides a suitable living space for the larvae. Vegetation structure also determines combustibility of larval habitats: As larval habitat sites were sparsely vegetated and available biomass was low, fire management is not applicable. Thus, burning in winter is not affecting *H. fagi*-populations within the vineyard slopes.

Restoration ecology: constraints and opportunities of ecosystem restoration - theory and practice.

BARBOUR, MICHAEL, SOLOMESCH AYZIK & BUCK, JENNIFER.

The University of California, Davis, CA., U.S.A.

Restoration Implications from a classification of California vernal pool vegetation

Approximately 1700 relevés were taken in 560 pools from all six Central Valley vernal pool regions, the data entered into a Turboveg database, analyzed with the statistical packages Juice and PC-Ord, and putative community types manually refined, floristically and ecologically defined, and named. Vernal pool communities in the Central Valley fell into one class and three orders: (1) an order of long-inundated pools unique in high constancy and abundance of the extremely flood-tolerant taxa *Lasthenia glaberrima* and *Eleocharis macrostachya*; (2) an order of short-inundated pool edges or shallow pools unique in the presence of such less-flood-tolerant species as *Blennosperma nanum*, *Cicendia quadrangularis*, *Lasthenia californica*, *Trifolium variegatum*, and *Triphysaria eriantha*; and (3) an order of saline-alkaline pool vegetation unique in the presence of such halophytes as *Cressa truxillensis*, *Crypsis schoenoides*, *Distichlis spicata*, *Eryngium aristulatum*, *Frankenia salina*, and *Pleruopogon californicus*. Below the orders were 6 alliances and 37 associations. The unique difficulties of classifying this ephemeral vegetation and of conserving and restoring it were summarized

CUTLER, SERAPHINA & MORGAN, JOHN

Department of Botany, La Trobe University, Bundoora, Australia.

Vegetation response following anthropogenic soil disturbance in different environmental stress contexts: an Australian perspective examining regeneration after fire break construction on mountain slopes

Stress and disturbance are two important factors that control the establishment and persistence of plants. While plants have evolved a range of strategies to help them persist in the landscape, current theory predicts that, in general, with increasing intensity of disturbance and environmental stress, there will be an increasing difficulty of recovery. In large scale restoration and rehabilitation projects, the level of assisted recovery required might depend on the context of (a) the intensity of disturbance and (b) the landscape in which that occurs. We test this idea by examining the early (2-year) response of vegetation following massive soil disturbance, caused by machine grading of fire containment lines as a part of bushfire suppression operations, in different landscape or stress contexts - along an elevation gradient through the foothills forests,

montane forests and subalpine forests of south-eastern Australia. Specifically the study asks: What are the regeneration strategies used by plants, and are certain strategies and life forms favoured by the disturbance? Is there evidence of autosuccession? Are patterns in the regeneration response context-dependent? Can the early regeneration/recolonisation after such a disturbance be predicted and, how does active assistance in the form of rehabilitation/restoration alter the state of regeneration?

KIEHL, KATHRIN

Vegetation Ecology, Technische Universität München, Am Hochanger 6, 85350 Freising, Germany.

Restoration of species-rich grasslands - how to overcome limiting factors?

All over Europe, species-rich semi-natural grasslands have strongly declined due to land-use intensification or abandonment. During recent decades, numerous projects on grassland restoration have been started, but restoration success is often constrained by biotic and abiotic conditions. After decades of heavy fertilization many typical grassland species have disappeared and have no possibility to find suitable regeneration niches in the tall productive vegetation. Both in species-poor grasslands and especially after decades of arable land use the seed bank of target species is depleted. Furthermore, species-rich grasslands, in which target species are still present, have become rare and are often isolated in fragmented landscapes. The successful dispersal of target species is probably the most limiting factor for the restoration of species-rich grasslands because traditional vectors for seed dispersal are missing, and many grassland species disperse only over a few metres per year. Therefore, measures for species introduction are necessary. In Britain and in other European countries, many studies on species introduction by sowing have been carried out. Many projects use commercially available seeds or seed mixtures, whereas only a few studies state to use seeds of local provenance. However, the problem to find seeds of local provenance on the market can easily be solved, when target species are directly transferred from species-rich donor sites onto restoration sites by plant clippings, hay or raked plant material and litter. These measures have been proven to be successful in calcareous and sandy grasslands as well as in fen and floodplain meadows.

MOORA, MARI & JÕGAR, ÜLLE

Institute of Botany and Ecology, University of Tartu, Lai 40, 51005 Tartu, Estonia.

Rare plant *Gladiolus imbricatus* responses to coastal and river flood-plain meadow restoration

Due to the abandonment of traditional small-scale farming, the number and size of semi-natural grasslands have dramatically declined in Europe and plant species of semi-natural grassland communities are therefore faced with habitat loss, population fragmentation and isolation. In two separate grassland restoration experiments, the effect of biomass removal (grazing, mowing, spring burning) in comparison with non-managed control was estimated on the natural population density and life stage structure (in coastal meadow) and experimentally added seed recruitment (in river flood-plain meadow) of a rare species *Gladiolus imbricatus*. In coastal meadows, the population density increased in response to the mowing treatment but not in response to the grazing. All management regimes shifted the population structure towards a dynamic state where juvenile stages dominate, while the unmanaged control retained a regressive population structure. In the river flood-plain meadow, the mowing treatment increased the seed recruitment compared with spring-burning and non-managed treatment. We conclude that mowing is an optimal management regime for *G. imbricatus* in both coastal- and river flood-plain meadows. However, since extensive mowing of meadows is sometimes not possible for technical or socio-economic reasons, alternation of mowing and grazing in those areas may contribute to an improved status of *G. imbricatus*.

DE BELLO, FRANCESCO¹ & PÄRTEL, MEELIS²

¹ CNRS, Grenoble, France; ² University of Tartu, Tartu, Estonia.

Biodiversity indicators for restoration of European semi-natural grasslands and shrublands

Semi-natural grasslands and shrublands are crucial hotspots for biodiversity in Europe. In the complex context of land use and climate changes, general frameworks for assessing the need and success of biodiversity restoration are priorities for managers and policy makers. Specifically, easily measurable indicators are expected to produce reliable estimations of the trends, risks and recovery of biodiversity in these systems. We reviewed the traditional and potential indicators for grassland and shrubland biodiversity, proposing a framework for

interdisciplinary exchanges and discussing strengths and weaknesses of specific indicator systems. Different types of indicators are recognized. In particular, biotic indicators (e.g. synthetic lists of species, diversity indices, species and trait composition, vegetation structures etc.) can indicate biodiversity status directly or give, indirectly, information on the drivers that affect biodiversity (management/disturbance regimes, environmental conditions, landscape patterns). Precise information on such drivers is often unknown, or not easily accessible, but offers an important indicator system for monitoring biodiversity on its own. The biggest gap in biodiversity indications in semi-natural European grasslands and shrublands is the general lack of standards and the use of 'grey' literature only, which make the validation of indicators difficult.

PEET, ROBERT

Curriculum in Ecology, University of North Carolina, USA.

The impact of anthropogenic alteration of hydrology and sedimentation on the landscape ecology of the Roanoke River, North Carolina, USA

The Roanoke River of the North Carolina Coastal Plain is widely recognized as the best remaining example of a natural riparian landscape on the Atlantic coast of the US. However, the vegetation of this supposedly pristine landscape has been dramatically altered by human activities. Upstream dams constructed since 1950 have altered the hydrology, not only removing extreme high and low flows, but also increasing the duration of moderate flooding for extended periods in the spring. In addition, post-colonial agriculture in the upper watershed resulted in significant erosion, with the consequence that an estimated $2.4 \times 10^9 \text{ m}^3$ of soil was eroded and carried down the Roanoke. We estimate that $0.7 \times 10^9 \text{ m}^3$ remains stored in the floodplain of the lower Roanoke. This sediment, in places $> 5\text{m}$ deep, has dramatically altered the geomorphology and vegetation of the landscape. Construction of dams on the river has halted the addition of new sediments, but older sediments are being eroded and redeposited. We determine past and future landscape surface by measurements of post-colonial sediment depths, together with current rates of erosion and deposition. We use this information to assess past and future vegetation of the Roanoke River floodplain.

ŘEHOUNKOVÁ, KLÁRA

Department of Botany, Faculty of Biological Sciences, University of South Bohemia, Branišovská 31, CZ-37005 České Budějovice, Czech Republic.

Spontaneous vegetation succession in disused gravel-sand pits: role of local abiotic factors and the surrounding landscape

Vegetation variability, participation of target and undesirable species, role of local site and landscape factors and importance of the species pool were studied in disused gravel-sand pits (36) in various regions of the Czech Republic, Central Europe, comprising successional stages of different age. Three types of sites were distinguished: dry, wet, and hydric in shallow flooded sites. Ordination analyses showed that spontaneous vegetation succession led to the formation of either shrubby grassland, mesic deciduous woodland, alder & willow carrs, and tall sedge or reed & cattail beds in later stages, depending predominantly on the local site factors (especially site moisture) and presence of (semi-)natural vegetation in the surroundings (the local species pool). Although the water-table was the most influential on the course of vegetation succession, landscape factors together explained more vegetation variability (44%) than local site factors (23%). The invasion of the alien tree *Robinia pseudacacia* must be taken into consideration in the dry sites in lowlands. Plant functional groups can be useful tools in predicting colonization success of species occurring in surrounding (semi-)natural vegetation, into disused gravel-sand pits. The probability to colonize gravel-sand pits decreases with succession (young stages – 41%, middle stages – 30%, late stages – 15%).

ROSENTHAL, GERT¹ & MÜLLER, JOSEF²

1 Institute of Landscape Planning and Ecology, University of Stuttgart, Germany. 2 Institute of Ecology and Evolutionary Biology, University of Bremen, Germany.

Restoration of wet meadow communities after long-term abandonment

In order to recover biodiversity after 30 years of abandonment, a mowing regime (two cuts/year) was re-established in previous *Calthion* and *Caricion fuscae* communities which had been abandoned in the Oste valley (NW Germany) by the 1950s. Starting with extremely species-poor tall forbs and tall grass communities (*Filipendulion* / *Magnocaricion*) we found a significant reduction of the standing crop with re-mowing and a

threefold increase of the species numbers on permanent plots already during the first years. Small-growing vascular plants such as *Lychnis flos-cuculi* became dominant, which significantly changed the vegetation structure and flowering aspects. The new established plant species partly represented the species pool of former Calthion and Caricion fuscae communities which had been recorded on these stands in 1952, prior to the abandonment. They established from the soil seed bank which apparently survived the fallow period. On the other hand, other target species such as *Carex fusca*, *Bromus racemosus* and *Senecio aquaticus* failed in re-colonizing even though an appropriate mowing regime had been installed. Our experiments show that wet fallow communities are capable of storing seeds and therefore “memorizing” previous biodiversity conditions for decades. However, it was not possible to re-establish the complete species assemblage of original plant communities, due to limited seed persistence and reduced invasion from the surrounding landscape.

SMITS, NINA

Landscape Ecology, Institute of Environmental Biology, University Utrecht, The Netherlands.

Restoration possibilities of Nardo-Galion saxatilis communities in southern Limburg, The Netherlands

Nardo-Galion grasslands on slopes in South Limburg used to be very species-rich ecosystems with characteristic species such as *Spiranthes spiralis*, *Antennaria dioica* and *Botrychium lunaria*. The traditional use of these slopes was common land, mostly grazed by sheep led by shepherds. At the beginning of the 20th century, these nutrient-poor grasslands strongly declined both in number and area due to changing land-use practices, such as intensification of agricultural use and abandonment. As a result, many of the characteristic plant species have disappeared. One of our aims is to reveal possibilities for restoring these nutrient-poor grassland slopes. Therefore, the current vegetation composition and soil chemistry were determined in Dutch Nardo-Galion communities. Subsequently, well-developed reference sites were selected in Belgium and Germany. First results showed no clear restrictions in soil parameters for restoration, although nitrate levels were significantly higher in Dutch sites. Multivariate analyses revealed that buffering capacity related parameters are important in explaining the observed variance in species composition, together with nutrient availability. It is concluded that

fragmentation and isolation, due to changing land-use, seem to be the main causes for decline. Therefore, further research should focus on enlargement of the current grassland reserves.

Poster presentations –

Richert, Elke, Bianchin, Sylvi, Hammer, Gert,
Merta, Mariusz, Seidler, Christina & Heilmeier, Hermann
Interdisciplinary Ecological Center, TU Bergakademie Freiberg,
Germany

Flood Protection and Nature Conservation in the Weisseritz Area - Interdisciplinary Evaluation of Land Use Scenarios

“Flood Protection and Nature Conservation in the Weisseritz Area - Interdisciplinary Evaluation of Land Use Scenarios Flood protection and nature conservation are often considered not to be compatible. Within the framework of the project “Flood Protection and Nature Conservation in the Weisseritz area” (Eastern Erzgebirge, Saxony, Germany) measurements which integrate both flood protection and nature conservation were designed for two sub-catchments which were affected by floods in August 2002. Changes of land use such as extensification of grasslands, transformation of arable fields into grasslands, ecological transformation of forests, afforestation and establishment of small landscape structures such as hedgerows were in the focus of the project. For the two sub-catchments a detailed survey of the present state with respect to landscape ecology and hydrology via systems analysis and modeling was performed. On this foundation different land use scenarios were developed and evaluated both from a flood protection and nature conservation perspective. To this end, biotope types and landscape structure were analysed and evaluated using criteria from nature conservation on the one hand, and hydrology modeled by two tightly coupled models on the other hand. Results from this combined approach show that land use changes can substantially contribute both to flood protection and nature conservation”.

Rosenthal, Gert
Institute of Landscape Planning and Ecology, University of Stuttgart,
Germany.

Restoration of wet meadow communities after sustained abandonment

“In order to recover biodiversity after 30 years of abandonment a mowing regime (two cuts/year) was re-established in previous *Calthion* and *Caricion fuscae* communities which had been abandoned in the Oste valley (NW Germany) in the 1950s. Starting with extremely species-poor tall forbs and tall grass communities (*Filipendulion* / *Magnocaricion*) we found a significant reduction of the standing crop after re-mowing and a threefold increase of the species numbers on permanent plots already during the first years. Small growing vascular plants such as *Lychnis flos-cuculi* became dominant which significantly changed vegetation structure and flowering aspects. The new established plant species partly represented the species pool of former *Calthion* and *Caricion fuscae* communities which had been recorded on these stands in 1952 prior to the abandonment. They established from the soil seed bank which apparently survived the fallow period. On the other hand, other target species such as *Carex fusca*, *Bromus racemosus* and *Senecio aquaticus* did not recolonize even though an appropriate mowing regime had been installed. Our experiments show that wet fallow communities are capable of storing seeds and therefore ““memorizing”” previous biodiversity conditions for decades. However, it was not possible to re-establish the complete species assemblage of original plant communities due to limited seed persistence and reduced invasion from the surrounding landscape”.

Mudrak, Ondrej 1 2, Velichova, Vaclava 1 & Frouz, Jan 2

1 Faculty of Biological Sciences, University of South Bohemia, Czech Republic. 2 Institute of Soil Biology, Biology Centre of the Academy of Sciences of the Czech Republic.

Herbaceous vegetation in reclaimed and unreclaimed post-mining woodland stands.

“In the Sokolov region (Czech Republic) spoil heaps after brown coal mining are reclaimed by tree plantations; they are planted directly into the rough substrate (alkaline clay). We evaluated a composition of the herbaceous layer of 7 types of woodland stands each in 4 replicates (*Alnus*, *Larix*, *Picea*, *Pinus*, *Quercus*, *Tilia* and sites left to spontaneous succession). Stand age ranged from 20 to 35 years. Cover of plant species was visually estimated in plots 5 x 5 m and in total 17 environmental and community variables were quantified. The type of dominant tree was correlated with herb species composition. Correlations were also found between species compositions and the following variables: water-soluble P, tree biomass, conductivity and Ca. The highest average species number

was in *Quercus*, he lowest in *Alnus* plots. Spontaneous succession was in species number the most variable stand, but in average was close to *Quercus* plots. Testing correlations of various community properties and species number, best correlation was found between cover of tree layer and cover of herb dominant *Calamagrostis epigejos*".

Smits, Nina,

Effects of fire, water and wind on vegetation

LE DUC, MIKE

Applied Vegetation Dynamics Laboratory, University of Liverpool, UK.

Environmental drivers of the vegetation of British woodlands

The paper presents an analysis of a large scale national survey of British woodlands. Using multivariate analysis, with variation partitioning, we assessed a number of abiotic variables with differing scales of influence (national, local, plot). Geo-spatial, climatic, landscape and pollution factors were used to produce the broad-scale analysis. At that scale, geo-climatic factors were shown to be responsible for 28% of variation in composition. At more local scales, biotic factors become relatively more important.

MARRS, ROB

Applied Vegetation Dynamics Laboratory, University of Liverpool, UK.

Competing conservation goals, biodiversity or ecosystem services

Conservation management in Europe is often geared towards restoring semi-natural ecosystems, where the objective is to reverse succession and re-establish early-successional communities, to comply with national and international conservation targets. At the same time, it is increasingly recognised that ecosystems provide services that contribute to other, possibly conflicting policy requirements. Few attempts have been made to define these conflicts. Here, we assess some potential conflicts using a *Calluna vulgaris*-dominated moorland invaded by bracken (*Pteridium aquilinum*) as a model system, where the current policy is to reverse this process and restore moorland.

MERUNKOVÁ, KRISTINA

Department of Botany and Zoology, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic.

Environmental correlates of species richness in Czech upland grasslands

A wide range of grassland vegetation types was studied in the Bohemian-Moravian Uplands (Czech Republic). Alpha-diversity of 225 plots of 16 m² were related to soil properties (pH, calcium, magnesium, phosphorus and potassium, conductivity, organic matter content, soil depth), climatic factors (mean annual temperature and rainfall), potential direct incident radiation and Ellenberg indicator values for moisture, light and nutrients. Multiple regression revealed species richness to be positively associated with moderate moisture and pH, low productivity, higher conductivity, mineral soils and occurrence in warmer regions. Regression trees were used to uncover major interactive effects of studied factors. The optimal tree consisted of six splits and by encompassing 52% of species richness variation confirmed the important roles of productivity, moisture, pH and temperature in explaining the observed diversity pattern. The relationship between species richness and pH was unimodal with a maximum at higher pH levels in low to moderately productive grasslands, while in highly productive grasslands no significant relationship was found. The negative relationship between species richness and phosphorus was most pronounced in low productive grasslands, on soils with high potassium content.

MÜLLER, SANDRA C.¹, OVERBECK, GERHARD, E.², PFADENHAUER, JÖRG,² & PILLAR, VALÉRIO D.¹

1 Departamento de Ecologia, Universidade Federal do Rio Grande do Sul, Brazil; 2 Vegetation Ecology, Technische Universität München, Germany.

Woody vegetation dynamics in burned subtropical grassland in a forest-grassland mosaic

Fire is common in grassland ecosystems, as it is in natural mosaics of grassland and forest in South Brazil, where forest and grassland woody species can be present in grassland dominated by tussock grasses. The main question is how woody species react to fire in frequently burned grassland in grassland-forest ecotones. Woody plants (< 10 cm height) were sampled in two survey periods in plots on 12 grassland transects, located at forest borders. Species composition, diversity and category (resprouter, non-sprouter) were analyzed according to time elapsed since last fire. 76 species (31 grassland shrubs; 45 forest shrubs) were sampled; 65.8% were resprouters. Density, richness and diversity were lower in

recently burned plots, especially on south exposed sites. For grassland shrubs, species richness and density were higher in plots unburned for one and two years than in unburned for three years. Resprouter shrubs were always denser than non-sprouter. Resprouter trees predominated in north exposed sites. Different recruitment dynamics types were detected. The high proportion of resprouter species in burned grassland and the recruitment rate of seeders characterize communities under frequent disturbance with well-adapted species. Fire intervals of two to three years do not avoid shrub encroachment but retard the advance of forest species over grassland.

RUMPF, LIBBY

School of Geography, Anthropology and Environmental Studies,
University of Melbourne, Australia.

A lesson in baking: The response of alpine treelines in Australia to fire

Due to the importance of fire on the Australian landscape it is imprudent to make assumptions on tree-line migration based upon the effects of global warming alone. This paper will present the findings of a study focusing on the effects of recent alpine wildfires on seedling recruitment and mortality of the Australian snow gum (*Eucalyptus pauciflora*) over the tree-line ecotone. The aim was to determine whether tree-line position will retreat, advance or remain stable following fire. Recruitment of seedlings was common, in conjunction with generally low mortality of trees. Seedling density dropped dramatically past the tree-line, and approximately 90% of alpine seedlings occurred within 10 metres of the tree-line. In comparison to unburnt sites, this did not translate to an expansion of range, but reflected a substantial increase in tree density. Seedling distribution is highly variable according to site, but it was found that this variability can be explained (with a Generalized Linear Model) in relation to factors such as distance from the tree-line, geology and proximity to outpost trees. Assuming survival of these seedlings, the time taken to reach reproductive maturity will ensure a lag in the response of the tree-line to rising temperatures.

WHELAN, ROBERT J., STREVENS, TANYA & BRADSTOCK, ROSS A.

Institute for Conservation Biology & Law, University of Wollongong,
NSW, 2522, Australia.

Fire management for conservation: How can we respond to a changing landscape and climate?

In fire-prone regions of the world, conservation of biodiversity requires active management of fire regimes. This is a difficult enough task at present, given the paucity of knowledge of species responses to fire, but it must be achieved in an increasingly fragmenting landscape and with changing climatic conditions. In this paper, we use recent climate models to explore the likely changes in fire regimes in Australia over the coming century. In the context of current policies for managing natural vegetation to protect human lives and property, we summarise the likely impacts of the altered fire regimes on humans and on biodiversity. Using several case studies from the highly fire-prone south east of Australia, we quantify the increase in the length of the urban-bushland perimeter that has occurred over the last 50 years, as a result of urban expansion. We conclude that management of native vegetation for the protection of human life and property in increasingly urbanized landscapes will pose significant challenges for threatened species conservation.

Poster presentations –

Fidelis, Alessandra, Blanco, Carolina, Müller, Sandra C., Pillar Valério D. & Pfadenhauer, J.
Chair of Vegetation Ecology, Technische Universität München, Germany.

Vegetation regeneration in subtropical grasslands in Brazil: effects of fire and mowing

“Subtropical grasslands are influenced by disturbance in several ways. The aim of our study is to analyse vegetation recovery after controlled burning and mowing experiments in Southern Brazil. Plots were randomly established in a frequently burned area. Seven plots (25 m²) were burned (B), six (4 m²) had their above-ground biomass removed (M) and five were established as control (C). In each plot, six continuous subplots (0.04 m² each, total of 2.4 m²) were established and vegetation relevés were carried out before and one month after experiments. Species were grouped in three functional groups: graminoids, forbs and shrubs. Bare soil and litter cover were also sampled. Bare soil cover increased in plots B after experiments, whilst litter cover increased in plots M.

Resprouting showed to be the most important plant strategy for all functional groups and treatments (ca. 75%). Few seedlings could be observed after one month. Only shrub covers had no significant differences between plots and after experiments. Forb regeneration showed to be slower in Plots M. Our results point out the relevance of resprouters in subtropical grasslands and consequently, the importance of the bud bank for vegetation dynamics”.

Harris, Mike

Applied Vegetation Dynamics Lab., University of Liverpool, UK.

Temperatures during moorland burning

“Prescribed burning is an important management tool in moorland management. Recently in the Peak district of the UK a burning technique has been developed which allows burning to take place in “wetter conditions” when it has been assumed that the temperatures produced were cooler. We have measured the temperatures during these cool burns and hope to relate it to fuel load and vegetation development”.

Ling, M. A.* & Cahalan, C. M.

School of the Environment and Natural Resources, University of Wales, Bangor, UK.

Importance of planting material provenance in hard rock restoration activities at a slate quarry in Wales, UK

“These studies are investigating the effect of provenance of planting material on the success of restoration of a slate quarry in Wales, UK. Cuttings were taken from 16 *Salix caprea cinerea* trees; eight (the quarry trees) were growing on large blocky slate waste within the confines of a slate quarry, and eight (the non-quarry trees) were growing on agricultural field margins. Shoot cuttings were taken in April 2006 from branches exceeding 10 mm in diameter and cut to lengths of 250 mm. Cuttings were rooted in artificial slate waste tips created by filling box pallets with layers of large fraction slate waste (>250 mm diameter) and minimal slate processing fines (0-4 mm diameter). A randomised block design with three blocks, 16 donor trees and five-cutting plots was used, and records of survival, shoot production and shoot growth were made. After three months growth, non-quarry trees were performing significantly better than quarry trees. In the second year, rooted cuttings will be subjected to different drought treatments. Provenance experiments of *Acer pseudoplatanus*, *Betula pendula*, *Ulex europaeus*, and *Cytisus*

scoparius have been initiated using plants grown from locally collected seed, and the results of these experiments will be presented”.

Rünk, Kai, Zobel, Martin & Zobel, Kristjan
Institute of Botany and Ecology, University of Tartu, Estonia.

What are the key factors for three congeneric (*Dryopteris*) forest ferns with contrasting regional abundance: soil, illumination or something else?

“Seemingly ecologically similar and taxonomically closely related species can exhibit striking differences in distribution and abundance without any apparent clue for explaining the pattern. We studied three congeneric fern species with contrasting regional abundance - *Dryopteris carthusiana* (common in Estonia), *D. expansa* (grows in scattered localities), *D. dilatata* (rare in Estonia) - with the aim to elucidate the relative role of three complex ecological factors: (1) illumination conditions, (2) edaphic conditions and (3) all remaining ones not included in the first two. The experiment was conducted in three localities - one inhabited by only *D. carthusiana*, the second inhabited by *D. carthusiana* and *D. expansa*, the third inhabited by all three. All species were grown in pots in three localities, in each locality rooted in soils of three different origins. Light conditions of each experimental plant were assessed from hemispherical photographs. The results of the experiment were unexpected - the origin of soil was important for the intermediate species (*D. expansa*), moderately important for the common *D. carthusiana* and not important for the rare *D. dilatata*. Also the effect of soil was different in different localities. Light availability was a good predictor of plant biomass, showing that plants were light-limited in the experimental sites”.

The ecology of invasive species

BOULANT, NADINE, KUNSTLER, GEORGES, RAMBAL, SERGE, & LEPART, JACQUES

CNRS, Centre for Functional and Evolutionary Ecology, 1919 Route de Mende, 34293 Montpellier Cedex 5, FRANCE

Quantifying the effects of grazing and water stress on invasive pine species seedling recruitment in Mediterranean grasslands

Invasion of open habitats by trees is a worldwide phenomenon. With global change, knowledge of climate and management effects on seedling recruitment, a key parameter for tree dynamics, is needed. We quantified the effects of sheep grazing and water stress on two invading pine species in dry grasslands of Southern France, the native *Pinus sylvestris* L. and the introduced *Pinus nigra* Arn. ssp. *nigra*. Age structures of 4 to 17 years old saplings were determined in 32 sites. Several water stress indexes were built from a model of soil water content that was tested with field measurements. Parameters affecting seedling recruitment were estimated by maximum likelihood with a model including the number and age of seeders and seed dispersal distances. Models that best fitted data were determined with Akaike's Information Criterion. *Pinus* recruitment in grazed and calcareous grasslands was lower than in ungrazed and dolomitic grasslands, and summer water stress duration further reduced it. Neither grazing nor geological substrate had an effect on sapling diameter or height growth. The two pine species differed in their growth rates, net fecundities and susceptibility to grazing. We discuss the expected dynamics of the two pine species under changes in climate and management practices.

CLOSSET-KOPP, DÉBORAH

Department of Botany, University of Picardie Jules Verne, 1 Rue des Louvels, 80037 Amiens Cedex, France.

Growth and foliar metabolism responses of the invasive *Prunus serotina* and its native competitor *Fagus sylvatica* along a nutrient gradient

American Black cherry (*Prunus serotina* Ehrh.) has become one of the most widespread invasive trees in western European forests, especially on nutrient-poor, well-drained soils. It is a gap-dependent species which is able to out-compete most native tree species. In its exotic range, its main

competitor is *Fagus sylvatica* L. To understand why *Prunus serotina* performs better on podzolic soils than on calcareous and/or moist soils, we designed a comparative study between *Prunus serotina* and *Fagus sylvatica* along a moisture/nutrient gradient under two light conditions (understorey vs. canopy gap). More specifically we tackled the following questions: 1. Do soil moisture and nutrient content influence foliar metabolism (i.e., chlorophyll content, carbon and nitrogen content, SLA?) and growth parameters (i.e., growth units and ring width)? 2. Does *Prunus serotina* exhibit a higher plasticity than *Fagus sylvatica* along the gradients? 3. Is *Prunus serotina* a better competitor than *Fagus sylvatica* because of a lower vulnerability to climatic variations (dendroclimatological study)?

DECOCQ, GUILLAUME

Department of Botany - University of Picardie Jules Verne, 1 rue des Louvels, 80037 Amiens Cedex, France.

A multidisciplinary approach of plant invasions: the case of *Prunus serotina* Ehrh. in northern France

Because biological invasions are not only an ecological threat but also a society question, a multidisciplinary approach to the question is required to manage them efficiently. I present such an approach for the American black cherry (*Prunus serotina* Ehrh.), a tree species which is spreading considerably throughout temperate European forests. A multidisciplinary study was implemented, aiming at (1) surveying *Prunus serotina* distribution among the forests of northern France and searching for factors controlling this distribution (biogeographical approach), (2) understanding population dynamics at both the local (i.e. forest stand) and regional (i.e. landscape) scales and analysing the impacts on both soil and vegetation (ecological approach), (3) modelling the invasion dynamics at different spatial and temporal scales (mathematical approach), (4) assessing how the different forest users perceive the alien (sociological approach), and (5) measuring the invasion-induced costs and benefits (economic approach). We focused on the public forest of Compiègne (13 644 ha), the most invaded in France. Overall, we found few short-term ecological and sociological impacts of the invasion, even when the landscape has completely changed over few decades. The alien is becoming integrated in Compiègne forest, in silvigenetic cycles as well as in the collective unconscious.

ISERMANN, MAIKE

Vegetation Ecology and Conservation Biology, University of Bremen, Leobener Strasse, NW 2, Room A 1030, D-28359 Bremen, Germany.

Effects of *Rosa rugosa* and *Hippophaë rhamnoides* on the phytodiversity in dunes

Dunes are one of the most valuable habitat types in Europe, which are often species-rich and contain a lot of regionally rare plants and animals. Therefore, the preservation of semi-natural grass- and heathlands has a high conservation priority. In the past, due to changing use of the area, landscapes often changed from open grassland to a higher content of shrub- and woodland. Due to changes of species richness and diversity, the expansion of species-poor shrublands e.g., with *Rosa rugosa* and *Hippophaë rhamnoides* poses a serious conservation problem. The aim of this study was to show effects of shrub encroachment on the diversity of dune vegetation and the environment. Establishment and spreading of shrubs like *Rosa rugosa* and *Hippophaë rhamnoides* in coastal dunes resulted in a strong decline in light availability, followed by a shading-out of typical species of open dune grasslands as well as of dune heathlands. Shrubland dominated by few species such as *R. rugosa* or *H. rhamnoides* was characterized by a simple vegetation structure and has a low conservation value. Species richness as well as species diversity declined with increasing shrub cover. Due to the different growth- and leaf-forms of *Rosa* and *Hippophaë*, shading-out effect and decline of both species richness and diversity were more improved in the *Rosa* shrubland than in the *Hippophaë* shrubland. Moreover, the growth under a wide range of environmental factors supports the competition effort of *Rosa*. *R. rugosa* grows denser and has broader, more shading leaves, hence a stronger shading-out effect exists; which resulted in a decline of many light-demanding species already at a small scale. In contrast, due to smaller leaves and a more open growth-form, in the *Hippophaë* shrubland small gaps remained also in dense shrubland, and, many species typical of open dune grasslands remained in shrubland.

Poster presentations –

Assaeed, Abdulaziz

College of Food & Agricultural Sciences, King Saud University, Saudi Arabia

Seed production and dispersal of *Rhazya stricta*

“*Rhazya stricta* Decne (Apocyanaceae) is an evergreen noxious shrub invading rangelands of Saudi Arabia. Overgrazing is observed to accelerate the spread of the species. Information on the invasion ecology of *R. stricta* is lacking. A study was conducted to: (1) determine seed production of the species and (2) evaluate the effect of wind direction on seed dispersal. Seed production was estimated from 20 mature plants in two different sites. Seed dispersion was determined using seed traps positioned at distances of 0.5, 1, 1.5 and 2.0 m from the edge of 10 mature plants in all cardinal directions. Seeds were collected from the traps at the end of the growing season. Results indicated that seed production of *R. stricta* was highly variable and ranged between 10286 and 18315 seeds per plant in two different sites. Results also revealed that wind direction had no influence on dispersion of seeds; however, the bulk of seeds (50%) were dispersed near the source plant. Over 85% of the collected seeds fell within a distance of 1.5 m from the source plant”.

Esquivias Segura, M.P., Zunzunegui, M., Álvarez L., Díaz Barradas, M.C.

University of Sevilla, Spain.

Facilitation or competition? Possible invasive traits of *Retama monosperma* in the Algarve region (Portugal)

“*Retama monosperma* is a leguminous shrub widely expanding during recent years in coastal dunes of the south-western Iberian Peninsula. This study tests the invasibility of this species in a littoral dune ecosystem of southern Portugal. Two woody species were chosen to be studied with interaction with *Retama* influence and without: *Thymus carnosus* (Labiatae) and *Helichrysum picardii* (Asteraceae). Ecophysiological measurements were taken in July and September 2006, during the dry season, in order to analyse the effect of *Retama* on their light and water use under stress conditions. Leaf water potential, net photosynthetic rates, chlorophyll fluorescence, leaf chlorophyll content and leaf proline content were measured. Differences were found between individuals under *Retama* influence and isolated ones. Photosynthesis was higher in the latter case, even when the others presented more chlorophyll content and higher photochemical efficiency. In general, plants in interaction presented a lower water potential and a higher amount of leaf proline. The

results show that *R. monosperma* competes with *T. carnosus* and *H. picardii* for water resources during the dry season, and prevents the plants in interaction from a more efficient use of light even when they present better physiological conditions than the isolated ones”.

Marozas, Vitas & Straigyte, Lina

Department of Ecology, University of Agriculture, Kaunas, Lithuania.

Comparative analysis of alien red oak (*Quercus rubra* L.) and native common oak (*Quercus robur* L.) vegetation in Lithuania

“The aim of this study was to determine the differences in alien *Quercus rubra* and native common oak *Quercus robur* vegetation structure and species composition. Investigations were done in Southwestern Lithuania. Plant species composition of *Quercus rubra* forests was investigated in 2005-2006. 30 geobotanical descriptions were made. Projection cover was estimated according to the Braun-Blanquet scale. Geobotanical descriptions made in natural *Quercus robur* forests were selected and compared with *Quercus rubra* vegetation structure and composition. The difference of *Quercus rubra* and *Quercus robur* forests species composition was evaluated using Canonical Correspondence Analysis. Vegetation structure of alien *Quercus rubra* stands and natural *Quercus robur* forest differed. The cover of the second tree layer and the herb layer was lower in *Quercus rubra* stands, the cover of the shrub layer was slightly higher in *Quercus rubra* stands. Species numbers were significantly lower in *Quercus rubra* stands. The majority of characteristic nemoral eutrophic species was lacking in *Quercus rubra* stands”.

Effects of climate change on vegetation

BORNETTE, GUDRUN¹ & PUIJALON SARA²

1 : UMR CNRS 5023 "Ecology of Fluvial Hydrosystems", Université C.

Bernard Lyon 143, Boulevard du 11 novembre 1918, 69622

Villeurbanne Cedex, FRANCE. 2 : Netherlands Institute of Ecology (NIOO-KNAW), Centre for Estuarine and Marine Ecology, P.O. Box 140, 4400 AC Yerseke, The Netherlands.

Does eutrophication affects the regrowth of aquatic plants ?

Several papers suggest that eutrophication (through ammonium enrichment) would decrease the regeneration ability of aquatic plants, through a modification of the quality and quantity of stored resources. In the present study, we assessed whether 1) species that grow preferably under eutrophic conditions have a lower regrowth capacity than those growing under more oligotrophic situations, and 2) the trophic conditions of the habitat would affect regrowth capacity of species. A comparison of the regrowth rate of plant fragments of 15 species demonstrated a low positive correlation between regrowth of species and their trophic status in regard to ammonium. In an opposite way, survival and regrowth of the oligotroph species previously growing under contrasting trophic conditions was higher for plants originating from the more oligotrophic habitats. Eutroph species are able to regrow as well, and even better than oligotroph ones. The survival and regrowth of the oligotroph species, decreases with eutrophication, suggesting an increasing risk of disappearance of such species in case of recurrent fragmentation. In the context of global eutrophication and increasing intensity and frequency of floods, such pattern would lead to lower regeneration and colonisation ability for oligotroph species.

HOELZEL, NORBERT

Institute of Landscape Ecology, University Münster, Germany.

Effects of heat waves on grassland vegetation – the extreme summer of 2003 as a model for the impact of future climate change

The 2003 heat wave that affected much of Europe from June to September bears a close resemblance to what many regional climate models predict for summers in the late part of the 21st century. In this paper, data demonstrating the impact of the extreme summer of 2003 on productivity and leaf nutrient concentration in different types of alluvial

grasslands along the river Rhine in Germany are presented. Similarly, in the same type of meadows strong and significant effects of extreme drought events on seed bank dynamics and seedling recruitment could be observed. All these findings strongly suggest a future shift in vegetation towards drought-tolerant species with low nutrient demands.

LLORET, F. ¹, LOBO, A. ², ESTEVAN, H. ³, VAYREDA, J. ³ & TERRADAS, J. ¹

1 Centre for Ecological Research and Forestry Applications, Faculty of Science, Barcelona University, 08193 Bellaterra, Barcelona, Spain.

Species richness and resistance to drought episodes in forests of Catalonia (NE Spain)

Current trends of climate change involve for some regions an increase in extreme climatic episodes. Drought episodes are likely to produce important transformations in the communities established in regional ecotones. Recent work in NE Spain using NDVI as an estimation of drought impact on forest canopy and forestry inventory data sets have allowed exploration of the role of woody-species richness on resistance to drought. We used NDVI anomalies of the dry summer in 2003 in relation to records of previous years. We considered different types of forests that are representative of the main climatic and altitudinal gradients of the region, ranging from lowland Mediterranean to mountain boreal-temperate climates. Our results show a shift on the diversity-stability relationship across the regional, climatic gradient. A positive relationship appears in drier localities, supporting the probability that finding a species able to cope with drier conditions increases with the number of species. However, in moister localities we hypothesize that the proportion of drought-sensitive species would increase in richer localities. The study points to the convenience of considering the causes of disturbance in relation to current environmental gradients and historical environmental constraints on the community.

KADIK-ACHOUBI, LEILA

Faculty of Biological Sciences, USTHB, BP 32 El Alia 16 111 Alger, Algeria.

Bioclimatology and vegetation diversity of Saharan Atlas Mountains in Algeria

Mediterranean forests were adapted to drought but they are in danger of disappearing. Among the ecosystems of the world, they are one of the most vulnerable because they have suffered long periods of anthropic actions, particularly grazing, cutting down trees and fire. Mediterranean climates are characterized by summer drought. In Algeria, effects of climate change on the vegetation has brought these ecosystems in a critical position. Our contribution concerns vegetal formations of the Saharian Atlas of Algeria. To define the climate and vegetation of this area we have used numeric analysis (AFC) for 201 samples and five climatic factors: altitude, annual rainfall, average minimal temperature (m) of the coldest month (January) and average maximal temperature (M) of the hottest month (July). We distinguished 13 vegetal formations; half of these ecosystems are much degraded. Secondly, the biological spectrum showed that phanerophytes are important, but the infiltration of therophytes and chamaephytes makes regeneration of forests difficult.

KIRPOTIN, SERGEY¹, POLISHCHUK, YURY² & BRYKSINA, NATALIA²

1Institute of Biology, Tomsk State University, 2 Department of Ecology, Yugorskiy State University Russia.

Breakage of endogenic cyclic succession of palsas as a result of sudden strengthening of thermokarst in a Sub-arctic region of Western Siberia in connection with global warming, according to ground and space monitoring

Peatlands situated in a permafrost zone, especially palsas in the sub-arctic region of Western Siberia, are a very sensitive indicator of climatic changes, such that any changes of climate in the direction of warming lead to increased activity in thermokarst processes over extensive areas. It is shown that the endogenous cyclic succession of palsa development was broken due to the imbalance of cryogenic processes: thermokarst started to prevail over permafrost heaving. Authors revealed that thermokarst has expanded over large areas of the Western-Siberian sub-arctic region and during the last 5-6 years it has probably become irreversible in character, which can be explained by climate warming. The level of thermokarst activity depends directly on the thickness of the peat layer of palsas: very active thermokarst is apparent in the areas where the peat layer of the frozen bogs is thin (about 20-30 cm; 50 cm max) and it is almost absent in the southern edge of the permafrost zone, where the thickness of frozen peat is about 1.5 - 2 m. One of the clearest confirmations of thermokarst

strengthening is the intensification of the process of disappearance of thermokarst lakes as a result of their drainage. This is well displayed on satellite images over time.

ZUNZUNEGUI, MARÍA¹, LHOUT, FÁTIMA AIN², DÍAZ BARRADAS, MARI CRUZ¹ & BOUTALEB, SAID².

1 Departamento de Biología Vegetal y Ecología. Apartado 1095. 41080 Sevilla, SPAIN. 2 Université Sidi Mohammed Ben Abdellah, Centre d'études Universitaires de Taza. Taza. Marrocco.

Effect of anthropic intervention on the ecophysiology of *Argania spinosa*

Argania spinosa is a Moroccan endemic tree species subjected to constant decline. This tree plays essential local, ecological and economical roles: it protects soils from erosion, it shades different types of crops, it helps maintain soil fertility in an arid climate, and its seeds are used for oil production, with nutritional, medicinal and cosmetic purposes. Furthermore, the pressed 'cake' remaining after oil extraction is used together with tree leaves for livestock feeding. The main object of this study was to assess the consequences of human intervention on *Argania spinosa*'s ecophysiology. Three locations with contrasted climatic and human pressure conditions were studied. Admine (coastal area, high human pressure, rainfall 215 mm/year), Argana (1460 m mountain area, low human pressure, rainfall 195 mm/year) and Beni Snassen (protected, 277 m hilly area, rainfall: 310 mm/year). Fifteen trees per site were marked and the following variables were monitored: photochemical efficiency, leaf water potential, photosynthetic rate, relative water content, photosynthetic pigments and proline contents and leaf area index. Plants from the Argana mountain showed the lowest photosynthetic index and water potential, while plants from the protected and the coastal areas showed similar photosynthetic rates and water potential, suggesting that *Argania spinosa* is more affected by weather conditions than by human pressure.

Poster presentations –

Kutnar Lado, Kobler Andre Slovenian Forestry Institute, Ljubljana, Slovenia

Potential impact of climate change on forest vegetation in Slovenia .

According to a scenario of hypothetically changed climate given as spatially uniform increase of the mean annual temperature of 2°C and decrease of the annual precipitation of 200 mm all-over Slovenia, the adaptation potential of forest vegetation has been estimated using spatial modelling. Under these changed conditions the forest vegetation type might be altered on 45% of all forest sites. The model-based simulation indicated that the share of forest type with predominant Dinaric fir-beech forests *Omphalodo-Fagetum* will significantly decrease. These forests, which are among the most economically and ecologically important in Slovenia, might eventually be replaced by different thermophilous deciduous forests and by other beech forests. The simulation indicated that Sub-Mediterranean beech forest of *Seslerio autumnalis-Fagetum* and thermophilous deciduous forests of *Ostrya carpinifolia*, *Quercus pubescens* and *Fraxinus ornus* could be extended from Sub-Mediterranean region to the continental part of Slovenia. That means the share of less economically interesting and more fire-sensitive forest will be significantly higher. Potentially, the share of beech forest of *Anemone trifoliae-Fagetum* and fir-beech forests of *Homogyno sylvestris-Fagetum* in Alpine and Pre-Alpine regions might decrease. In these regions, a significant part of the coniferous forest with predominant *Picea abies* and *Abies alba* might be converted to deciduous forests.

Full Programme of events

Monday 16th July

Burren Pre-Conference trip commences. Shannon airport 1630

Sunday 22nd July

- 0730-0900 Breakfast for residential delegates (early arrivals)
– Refectory, Fulton House
- 1215 Burren trip flight from Shannon
- 1325 Burren trip collected from Bristol
Airport
- 1400-1900 Registration desk open - Café West, Fulton House.
- 1600-1700 Arrival Tea – Café West, Fulton House
- 1800-2230 Bar open – JCs, Fulton House
- 1900 Dinner – Refectory, Fulton House
- 1930 Council Meeting – Room 1 Fulton
House

Monday 23rd July

- 0730-0900 Breakfast for residential delegates – Refectory,
Fulton House
- 0800-0900 Registration Desk open –Taliesin
Foyer
- 0830-0900** **Opening address** by Professor Mike Barnsley
Pro-Vice Chancellor of Swansea University –
Taliesin Theatre

Monday 23rd continued

0900-1300 **M1 Long-term vegetation dynamics linked to eco-informatics for understanding species dynamics in changing landscapes.**

-Taliesin Theatre

M2 Land-use history of woodlands and the present landscape - Faraday Lecture Theatre

1030-1100 Refreshments – Taliesin Foyer
Presenters are requested to put their posters on display.

1300 Lunch – Refectory, Fulton House

1400-1530 **M3 Long-term vegetation dynamics linked to eco-informatics for understanding species dynamics in changing landscapes.**

1530-1600 Refreshments – Taliesin Foyer

1600-1700 **M4 Poster sessions**

1700-1830 The Egypt Centre housing an exciting collection of Egyptian antiquities is open for a private viewing.

1730-1830 'Taste of Wales' Reception. An opportunity to view the IAVS Exhibition, posters and the Egypt Centre whilst enjoying some local Welsh delicacies and a glass of wine or juice. – Taliesin Foyer

1800-2300 Bar open – JCs, Fulton House

1830 Dinner – Refectory, Fulton House

Tuesday 24th July

0730-0900 Breakfast for residential delegates – Refectory, Fulton House

0830-0900 Registration Desk open – Taliesin Foyer

0900-1300 **T1 Beyond niche vs. neutral: what we still don't know about coexistence in plant communities.** - Taliesin Theatre

0900-1315 **T2 What factors determine grassland diversity?**
- Faraday Lecture Theatre

1030-1100 Refreshments – Taliesin Foyer

1300 Lunch – Refectory, Fulton House

1400 Delegates depart for National Botanic Gardens of Wales – coaches leave from the front of Fulton House

1500-1800 **Tour and Talk at National Botanic Gardens Wales**

1800 Return to Swansea

1800-2300 Bar open – JCs, Fulton House

1900 Dinner – Refectory, Fulton House

Tuesday 24th July continued

2000-2200 Editorial Board Meeting – Committee room 1, Fulton House

Wednesday 25th July

0730-0900 Breakfast for residential delegates– Refectory, Fulton House

Mid-Conference Excursions departures: - Meet at the front of Fulton House.

0830	Depart for Gower & Wye Valley
0900	Depart for Breacon Beacons & Dare Valley
0915	Depart for Craig-y-Nos & Nash Point
1830	All trips will have returned to campus.
1800-2300	Bar open – JCs, Fulton House
1900	Dinner – Refectory, Fulton House

Thursday 26th July

0730-0900	Breakfast for residential delegates – Refectory, Fulton House
0830-0900	Registration Desk open – Taliesin Foyer
0900-1300	TH1 Historic Landscape ecology: anthropogenic and abiotic influences on the landscape. –Taliesin Theatre
0900-1200	TH2 Plant animal interactions, especially grazing -Farady Lecture Theatre
1030-1100	Refreshments – Taliesin Foyer
1300	Lunch for TH1 Faraday – Refectory, Fulton House
1330	Lunch for TH2 Taliesin– Refectory, Fulton House
1400-1430	TH3 Historic Landscape ecology: anthropogenic and abiotic influences on the landscape
1430-1730	TH3 The ecology of invasive Species - Taliesin Theatre

- 1400-1700** **TH4 Effect of climate change on vegetation**
 - Faraday Lecture Theatre
- 1530-1600 Refreshments – Taliesin Foyer
- 1800-2400 Bar open – Café West, Fulton House
- 1845-1930 Wine Reception and Harpist – Café West
 1930 Symposium Dinner – Refectory,
 Fulton House
- 2115 Twmpath, a traditional event with The “Five Bar
 Gait” band.

Friday 27th July

- 0730-0900 Breakfast for residential delegates - Refectory,
 Fulton House
- 0830-0900 Registration Desk open – Taliesin Foyer
- 0900-1200** **F1 Restoration ecology.** – Taliesin
 Theatre
- 0900-1300** **F2 Effects of fire, water and wind
 on vegetation.**
 – Faraday Lecture Theatre
- 1030-1100 Refreshments – Taliesin Foyer
- 1300 Lunch – Refectory, Fulton House
- 1400-1530** **General Assembly and presentation of prizes**
 - Taliesin Theatre
- 1530-1600 Refreshments – Taliesin Foyer
End of conference.
- 1600 Cornwall Trip Departs – from the front of Fulton
 House

Saturday 28th July

0730-0900 Breakfast for residential delegates – Refectory,
Fulton House

List of delegates:

Surname	Name	Institution
Allan	Eric	Imperial College London, UK
Assaeed	Abdulaziz	King Saud University Riyadh, Saudi Arabia
Baeten	Lander	Gent University, Gent Belgium
Bakker	Jan	University of Groningen, The Netherlands
Barbour	Michael	University of California Davis, CA, USA
Bekker	Renee	University of Groningen, The Netherlands
Bergmeier	Erwin	University of Göttingen Germany
Bornette	Gudrun	University Claude Bernard Lyon, France
Boulant	Nadine	CNRS (CEFE) Montpellier, France
Box	Elgene	University of Georgia, Athens, GA, USA
Bruelheide	Helge	Halle University, Germany
Bruun	Hans Henrik	Lund University, Sweden
Closset-Kopp	Deborah	University of Picardie, Amiens, France
Cochrane	Valerie	Opulus Press, Stockport, UK
Cordlandwehr	Verena	University of Groningen, The Netherlands

Corporaal	Albert	Alterra, Wageningen, The Netherlands
Cousins	Sara	Stockholm University, Sweden
Crawley	Mick	Imperial College, London, UK
Cutler	Seraphina	La Trobe University, Melbourne, Australia
de Bello	Francesco	CNRS, Grenoble, France
Decocq	Guillaume	University of Picardie, Amiens, France
Deil	Ulrich	University of Freiburg, Germany
Dengler	Jürgen	University of Lüneburg, Germany
Diaz Barradas	Mari Cruz	University of Sevilla, Spain
Diekmann	Martin	University of Bremen, Germany
Eichberg	Carsten	Darmstadt University of Technology, Germany
Ejrnaes	Rasmus	University of Aarhus, Denmark
Esquivias Segura	Paz	University of Sevilla, Spain
Fergus	Alexander	University of Zürich Switzerland
Fidelis	Alessandra	Technische Universitat München, Germany
Fletcher	Victoria	Hampshire County Council, Winchester, UK
Fonseca Schinestsck	Camila	Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Fridley	Jason	Syracuse University, NY, USA
Garcia Novo	Francisco	University of Sevilla,

Glaves	Peter	Spain Biodiversity and Landscape History Research Inst., Sheffield, UK
Greulich	Sabine	University of Tours, France
Grime	Phil	Unit of Comparative Plant Ecology, Sheffield, UK
Grubb	Peter	Cambridge University UK
Harris	Mike	University of Liverpool UK
Heilmeyer	Hermann	Technical University BA Freiberg, Germany
Heiri	Caroline	ETH Zürich, Switzerland
Herben	Tomas	Academy of Sciences, Pruhonice, Czech Republic
Holzel	Norbert	University of Münster, Germany
Hovi	Antti	University of Helsinki, Finland
Hovstad	Knut Anders	Norwegian University of Life Sciences, Ås, Norway
Huiskes	Rik	Alterra, Wageningen, The Netherlands
Isermann	Maike	University of Bremen, Germany
Jamoneau	Aurelien	University of Picardie, Amiens, France
Jandt	Ute	Halle University, Germany
Janisova	Monika	Academy of Sciences, Bratislava, Slovak Republic

Jansen	Florian	University of Greifswald, Germany
Kammermeier	Sabine	Martin Luther University, Halle, Germany
Kattai	Kaili	Estonian University of Life Sciences, Tartu, Estonia
Kiehl	Kathrin	Technische Universität München, Germany
King	Tim	Wolfson College, Oxford, UK
Kutnar	Lado	Slovenian Forestry Institute, Ljubljana, Slovenia
Le Duc	Mike	University of Liverpool, UK
Leps	Jan	University of South Bohemia, Ceske Budejovice, Czech Republic
Ling	Matthew	University of Wales, Bangor, UK
Lloret	Francisco	Autonomous University of Barcelona, Spain
Ludemann	Thomas	University of Freiburg, Germany
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